IN THIS ISSUE

San Francisco Area Plant Engineers Form Association 47

Cut Electrical Breakdowns—Check Up on Care Operation 48
By Irwin Robbins

Three Basic Considerations in Plant Layout. *By G. W. Wallace* 50

Shooting the Roof Helps Trim Building Costs 52

Plant Ventilating System Layout and Planning. *By Tyler G. Hicks* . . . 54

Modern Rubbish Disposal—2 Trucks Do What 5 Used to Do 56

"Watch the Details"—Secret of Good Washroom Planning 58
By W. H. DeVore

. . . as a clamp . . . as a hanger . . . as a holder . . . and as a vise That's the Neg'ator 60

Some Facts the PE Should Know About Centrifugal Refrigeration 62
By Harold Woodhouse

Traffic Cops of the RPM. *By Carl F. Kirchhofer* 67

Pertinent Points to Consider in Roller Chain Applications 69
By Joseph Joy

Industrial Water Services. *By Robert K. Collier* 70

Check Tools, Techniques in Finishing Sprayed Metals 72
By John E. Wakefield

'Round About with the Editors 4

Plant Engineers' Digest 18

Rust-Resistant Anti-Friction Bearings . . . Safety Weather or Not . . . Use Double Care When Defrosting . . . Treatment of Waste Pickle Liquor . . . Business Is on the Move . . . Prevent Explosion Hazards in Industry . . . New Paint Applied by Heating . . . Aluminum Paints for Protective Coating . . . Metal That Melts in Your Hand . . . Dry Chemical Extinguisher Maintenance . . . An Ounce of Prevention . . . Proper Care of Wire Rope . . . Road Constructed During Cold Weather

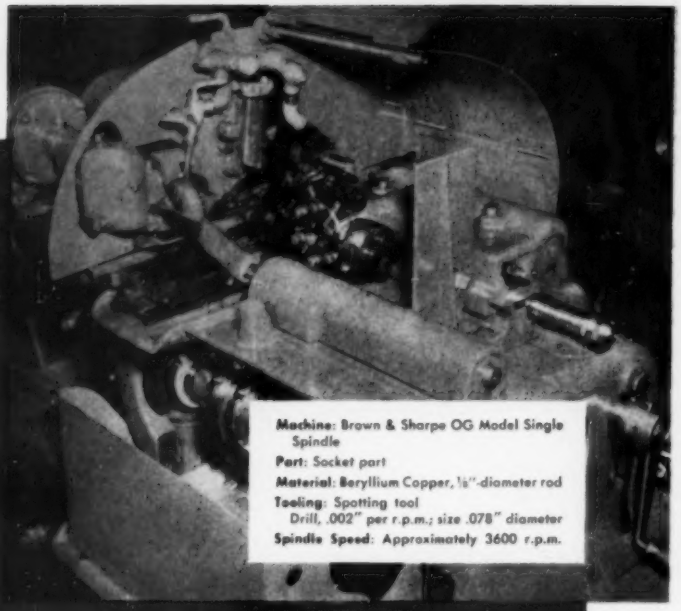
Maintenance and Operation 34

Solvents in "Low Places" Require Extra Care . . . Waste Heat Recovery Leads to Large Savings . . . Steel Is Pickled by Magic . . . Production Chart Ups Crews' Interest . . . Radiant Oven Degreases Metal Parts . . . Air Conditioning Watches and Clocks . . . Electric Heater Keeps Oil Flowing

Bulletins on Current Plant Problems . . . 37 — New Products and Methods . . . 76 — Data File and Library . . . 100 — New Books for Plant Engineers . . . 118 — Advertisers' Index . . . 122

Volume 4, No. 5 Circulation of this issue 29,379

3 TIMES LONGER DRILL LIFE and NO MORE STAINS*



Machine: Brown & Sharpe OG Model Single Spindle
Part: Socket part
Material: Beryllium Copper, ⅛"-diameter rod
Tooling: Spotting tool
Drill, .002" per r.p.m.; size .078" diameter
Spindle Speed: Approximately 3600 r.p.m.

WHEN this operation was performed with Texaco Cleartex Cutting Oil

FOUR major benefits resulted when the cutting coolant on the job described was changed to *Texaco Cleartex Cutting Oil:* (1) drills lasted three times as long; (2) uniform hole size was maintained; (3) staining of copper was eliminated; and (4) lubrication expense was reduced because *Texaco Cleartex Cutting Oil* can be used as both coolant and machine lubricant.

These benefits and economies are typical. Every day, in plants all over the country, Texaco Lubrication Engineers are helping to increase production and reduce costs.

Texaco Cleartex Cutting Oil is just one of a complete line of Texaco Products . . . designed to meet all operating conditions and assure better, faster, lower cost production.

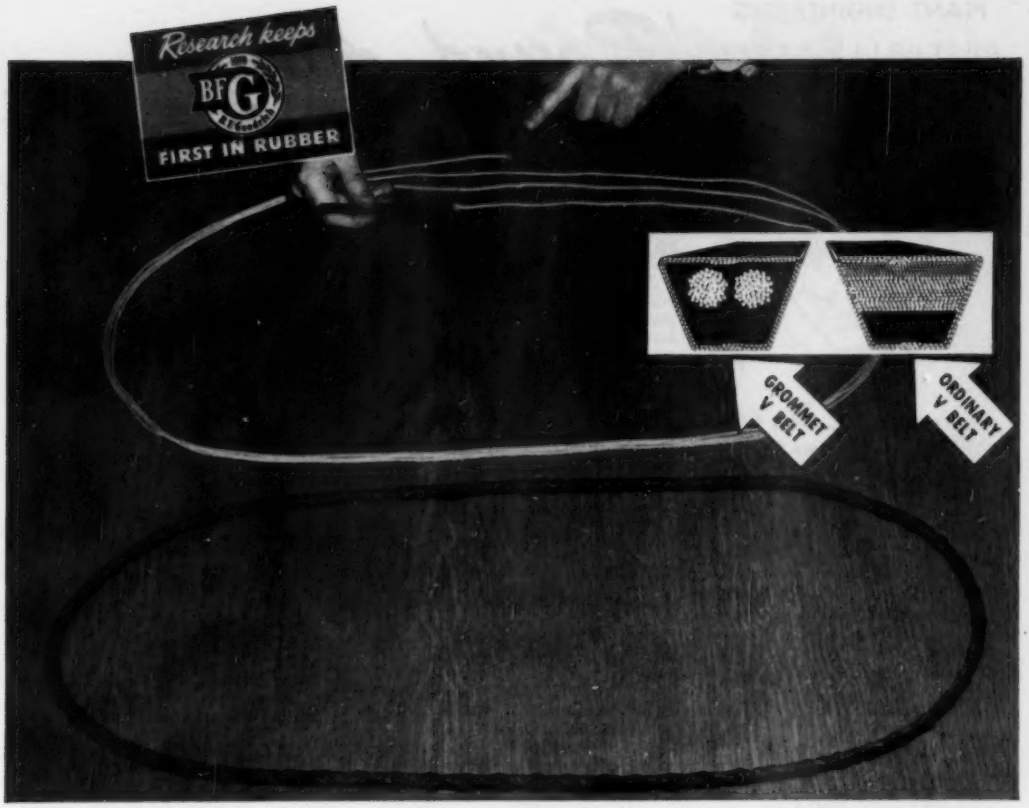
Let a Texaco Lubrication Engineer help you select the right coolants to assure these benefits in your plant. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

*Name of this Texaco user on request.

TEXACO

TEXACO Lubricants, Fuels and Lubrication Engineering Service

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.



How to eliminate most of your V belt cord failures

B. F. Goodrich grommet V belts last 20 to 50% longer, cost no more

IF YOU are now using ordinary V belts, most of your cord failures occur in the overlap section, where cord ends are joined. B. F. Goodrich grommet V belts use *endless* cord grommets, thus do away with the overlap section, eliminate the cord failures that normally occur there. That's one reason why BFG grommet belts last 20 to 50% longer, though they cost *not one cent more!* Here's the whole grommet story —

No cord ends — A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping ends (as in an ordinary V-belt cord section), no stiff, weakened section of "spliced" cord. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless cord section in a grommet V belt eliminates such failures.

Concentrated cord strength — All of the cord material in a B. F. Goodrich grommet V belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. This eliminates "dishing" of cords in the center of the belt, insures full use of all cord strength, maximum power delivery, even load distribution. No layers of cords to rub against one another and generate heat; cord and adhesion failures are reduced.

Better grip, less slip — Because a grommet is endless, free of stiff overlap, a grommet V belt is more flexible, grips the pulleys better. Size for size, grommet V belts will give ⅓ more gripping power, pull heavier loads with a higher safety factor.

Only B. F. Goodrich has the grommet! — Twin grommet construction is an exclusive, patented B. F. Goodrich feature — no other V belt is a grommet V belt. (U. S. Patent No. 2,233,294) To get genuine grommet V belts (at present made in D and E sections only) see your local B. F. Goodrich distributor. Ask him to show you his "X-ray" belt that illustrates grommet construction clearly. *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Grommet V Belts BY
B.F. Goodrich

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Subscription Information — Published Monthly. Prices: United States and Possessions one year $10.00, Canada one year $11.00. Other countries one year $12.00. Single copies $1.00.

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'Round About with the Editors

It Was M-Day on May Day

JUST TO KEEP you informed of the whereabouts of PLANT ENGINEERING's staff. On the first of May we moved into new quarters so, in the future just direct all beefs, orchids, articles, news items, new equipment announcements, samples, questions, answers, subscriptions, appeals, catalogs, bulletins, etc* to 110 South Dearborn St., Chicago 3, Ill. And speaking of May, as we were, come up and see us some time.

*You should pardon the expression, but advertising, too.

Technical Papers, Articles Encouraged by Dravo

ONE COMPANY is actively promoting the participation, by engineering and technical employees, in the presentation of papers and articles before technical societies and in business publications.

As evidence of the success of the plan twelve employees recently were awarded $500.00 in prizes in the company's 11th Annual Technical Paper Contest. Winners received their awards at the Dravo Engineers' Club annual dinner.

Cover of folder used by Dravo Corp. to encourage participation by employees in engineering association presentations and business publication articles

Chemical "Crop Insurance" For Lawns Developed

LAWN GRASS SEEDS in galoshes and overcoats—that's modern science's contribution this spring to assure grass seeders that the grass they seed will come up thicker and healthier.

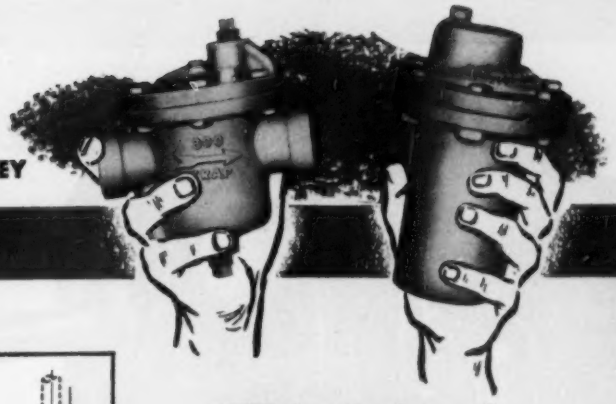
The "wraps" for these tiny seeds are actually coatings of a non-metallic, organic sulfur compound, developed through Du Pont research. Tests with typical lawn grass mixtures at an experimental laboratory at Minquadale, Del., have shown that treating the seeds with the chemical results in 46½% more healthy grass and clover plants from the same amount of seed sown.

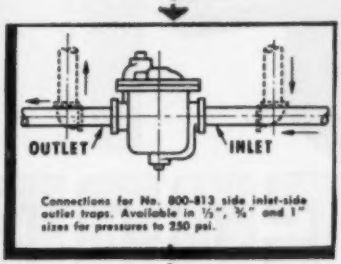
Of millions of seeds in a pound of lawn grass mixture, actual count shows only a small fraction ever produce plants that contribute to the lawn. Each seed is so tiny that its storage of plant food and energy necessary for sprouting and development is proportionately small. Pressed into cold, damp soil, a large percentage of seeds rot before a noticeable sprout can develop. Another large percentage sprout but are blighted by attacks of fungi in the soil before they can establish roots and began growth.

Weeds Thick? Trees Sick?

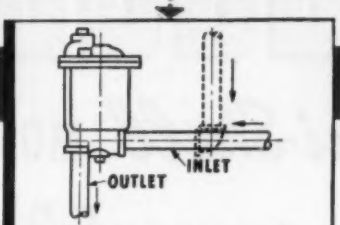
THE DAVEY TREE Expert Co. has announced expansion of its chemical brush and weed control division, headed by Homer L. Jacobs, technical services director. It is now geared to offer facilities for destruction of detrimental weeds and woody growth in industrial plant areas, along highways and along railroad rights-of-way. This is believed to be the first practical large-scale approach to the problem. Mr. Jacobs declared development of the division climaxes more than four years of intensive research, in which experiments were carried on in 21 states. Chemical "mowing" is said to effect 75 to 80 per cent complete kill on woody growth up to 15 ft high, as opposed to almost inevitable multiple new growth from the laborious old method of hand cutting.

YOU SAVE
TIME AND MONEY

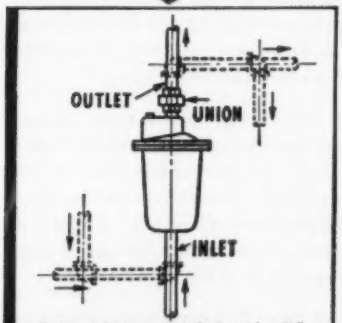




Connections for No. 800-813 side inlet-side outlet traps. Available in ½", ¾" and 1" sizes for pressures to 250 psi.



Side inlet-bottom outlet trap, ½" or ¾". Greatly simplifies connections to many types of small steam-consuming units.



Bottom inlet-top outlet body style. ½" through 2" connections. Cast semi-steel bodies for pressures to 250 psi. Forged steel bodies for pressures to 1500 psi.

"This choice of Steam Trap Body Styles simplifies installations"

IN THE most widely used sizes, Armstrong Steam Traps are available in either side inlet-side outlet or bottom inlet-top outlet body styles. This gives the user an opportunity to make exceptionally neat installations with a minimum of fittings and a minimum of labor and permits correct location of the trap in relation to the unit being drained.

In both styles the entire interior mechanism may be taken out for inspection or repair simply by removing the cap. The body, full of boiling water, is left in the line. In the case of the side inlet trap the cap may be removed without even disturbing the pipe connections.

Ask your nearby Armstrong representative to show you the opportunities for simplifying trap installations.

ARMSTRONG MACHINE WORKS
912 Maple St., Three Rivers, Mich.

THE 36-PAGE ARMSTRONG STEAM TRAP BOOK gives data and prices on the complete line of Armstrong steam traps for every pressure, every application. This book is a valuable reference for the calculation of condensate loads and the selection of traps for all classes of equipment. Send for free copy today

ARMSTRONG STEAM TRAPS

GOOD

ROBBINS & MYERS *Uni-Shell* MOTORS

NOW *made up to* 50 *h.p.!*

You asked for it. Here it is! Now you can get *R & M performance* in larger motors, too—from 1 to 50 h.p. in all motor types. It's one of the most welcome bits of news for Plant Maintenance Men since *steel-shell* R & M Uni-Shell Motors were first announced in 1942. And the many advantages of this modern design are even *more important* today.

BUILT TO KEEP GOING . . . Robbins & Myers Uni-Shell Motors *excel* in the three construction requirements for long, low-maintenance service. (1) *Durable Insulation*—the phase groups, as well as the coil groups, are insulated. (2) *Adequate Ventilation*—outside air circulates at high velocity through the rotor as well as between windings and shell. (3) *Long Bearing Life*—extra-wide ball bearings are double-sealed and prelubricated for years of use without re-greasing.

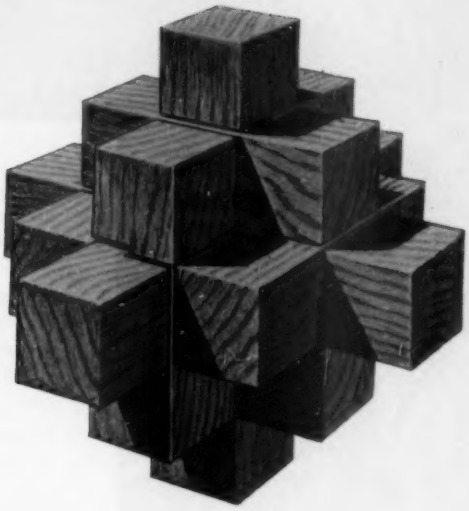
YOU SAVE TIME . . . All motor types in each frame size have *identical* mounting dimensions. Should current characteristics or service needs change, installation of a new motor is thus conveniently simplified. R & M Uni-Shell Motors are good motors—*easy to maintain.* Ask any R & M user.

Your R & M Motor Distributor will be glad to give you the interesting "inside story." Literature and recommendations on request. Please address Department J-50

ROBBINS & MYERS · INC. MOTOR DIVISION
Springfield 99, Ohio • Brantford, Ontario

MOTORS • HOISTS • CRANES • FANS • MOYNO PUMPS • FOUNDED 1878

Water problems interlock



IN virtually every plant, all water problems are so complexly interwoven that no one of them can be solved without reference to the others.

Solutions of a sort may be relatively easy, but you want that specific group of inter-related procedures which — weighing results against investment, operating expense and maintenance cost — represent the most efficient and economic solution to the problems in *your* plant.

You get this from Hall Laboratories for Hall is equipped, through years of experience and *continuing* research, to deal with all types of industrial water problems — selection of sources, treatment of plant water supply, boiler water conditioning and other problems in power generation, industrial process waters, waste recovery and disposal.

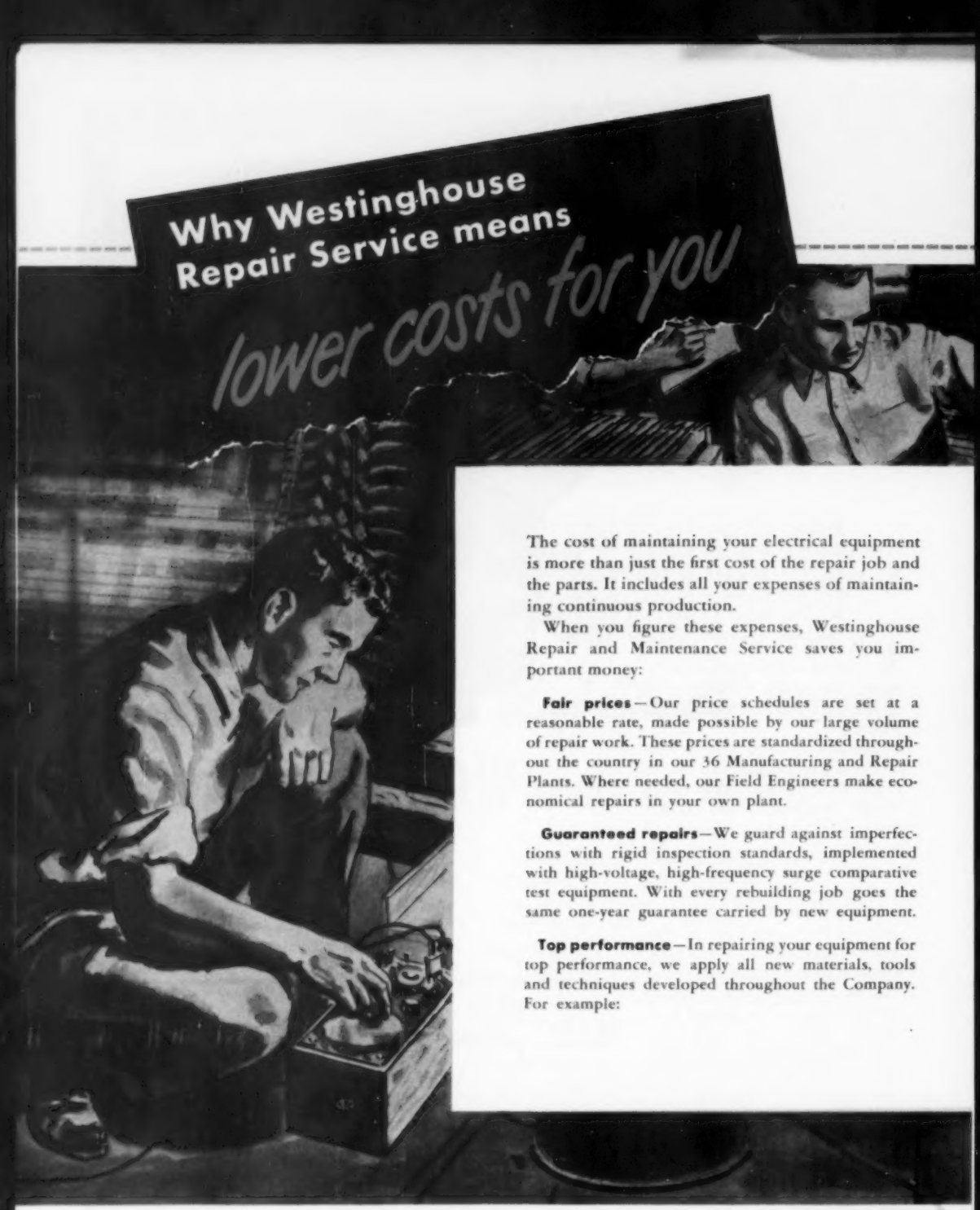
Hall *Plant-Wide* Water Service is your assurance that your water problems will be considered both individually and as a whole. May we send you a copy of our new bulletin "Let's Consider Your *Whole* Water Problem"?

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

HALL *plant-wide* WATER SERVICE

BOILER WATER CONDITIONING

PROCUREMENT, TREATMENT, USAGE AND DISPOSAL OF INDUSTRIAL WATER



The cost of maintaining your electrical equipment is more than just the first cost of the repair job and the parts. It includes all your expenses of maintaining continuous production.

When you figure these expenses, Westinghouse Repair and Maintenance Service saves you important money:

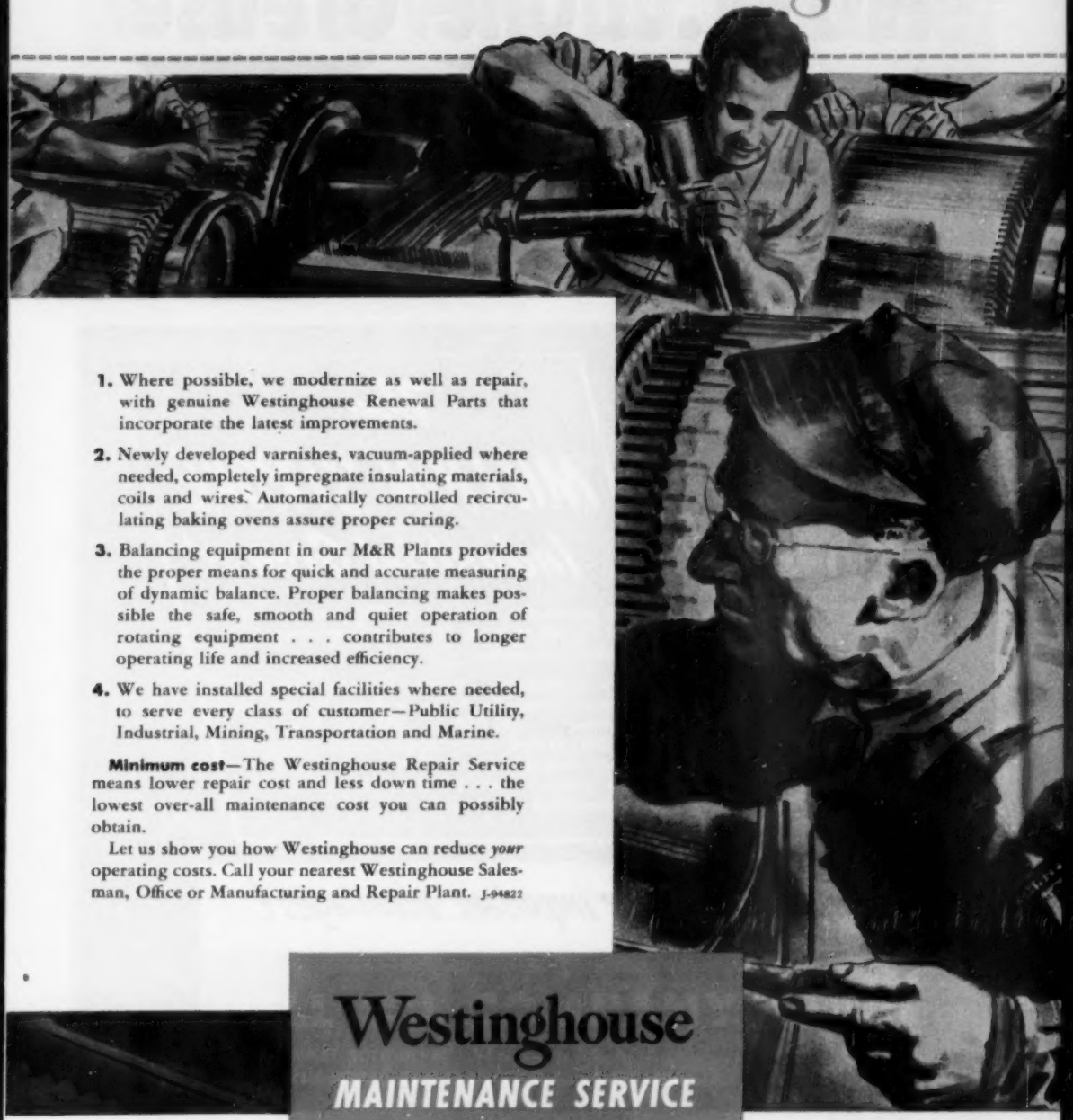
Fair prices—Our price schedules are set at a reasonable rate, made possible by our large volume of repair work. These prices are standardized throughout the country in our 36 Manufacturing and Repair Plants. Where needed, our Field Engineers make economical repairs in your own plant.

Guaranteed repairs—We guard against imperfections with rigid inspection standards, implemented with high-voltage, high-frequency surge comparative test equipment. With every rebuilding job goes the same one-year guarantee carried by new equipment.

Top performance—In repairing your equipment for top performance, we apply all new materials, tools and techniques developed throughout the Company. For example:

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



1. Where possible, we modernize as well as repair, with genuine Westinghouse Renewal Parts that incorporate the latest improvements.
2. Newly developed varnishes, vacuum-applied where needed, completely impregnate insulating materials, coils and wires. Automatically controlled recirculating baking ovens assure proper curing.
3. Balancing equipment in our M&R Plants provides the proper means for quick and accurate measuring of dynamic balance. Proper balancing makes possible the safe, smooth and quiet operation of rotating equipment . . . contributes to longer operating life and increased efficiency.
4. We have installed special facilities where needed, to serve every class of customer—Public Utility, Industrial, Mining, Transportation and Marine.

Minimum cost—The Westinghouse Repair Service means lower repair cost and less down time . . . the lowest over-all maintenance cost you can possibly obtain.

Let us show you how Westinghouse can reduce *your* operating costs. Call your nearest Westinghouse Salesman, Office or Manufacturing and Repair Plant. J-94822

Westinghouse

MAINTENANCE SERVICE

SHOP REPAIRS • FIELD REPAIRS

RENEWAL PARTS

NOW... One Grease applications in the

"The MILLION STROKE Industrial Grease"

A grease that will stand 100,000 punishing strokes of the ASTM Work Tester has been considered a superior lubricant.

In a deliberate attempt to break down Shell Alvania Grease, on the same tester, the run was extended . . . 200,000 . . . 300,000 strokes . . . 500,000 strokes! Finally, at one million strokes the test was discontinued, because this grease would not break down—it was still a fit lubricant both in appearance and consistency.

Combines all these important advantages!

1. **Higher mechanical stability** than *any* conventional grease at operating temperatures.
2. **Pumpable at low temperatures**—even in unheated storage.
3. **Stable at high temperatures**—superior to the best "soda" greases.
4. **Impervious to water**—excellent resistance to washing out.
5. **Longer Service Life**—reduced consumption.

SHELL ALVANIA . . .

will service all grease majority of plants

SHELL ALVANIA GREASE

Shell Alvania is the one grease that will service all grease applications in most industrial or processing plants. It is already making important changes in maintenance and purchasing practice.

Because Shell Alvania, a patented grease, combines *all* of the advantages of the many special purpose industrial greases, this new lubricant does a highly efficient job in most any application you can name.

Gives you these plant savings:

1. **Extends TIME between greasings**—lasts longer . . . stays in bearings for much longer periods.
2. **Low-cost application**—fewer servicings per year and *only the one grease to handle at any time.*
3. **Simple inventory**—Shell Alvania Grease replaces up to 20 brands formerly required.
4. **Greater safety**—less chance of applying the wrong grease to expensive machinery.
5. **Better protection**—against heat, cold and moisture.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, N. Y.
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

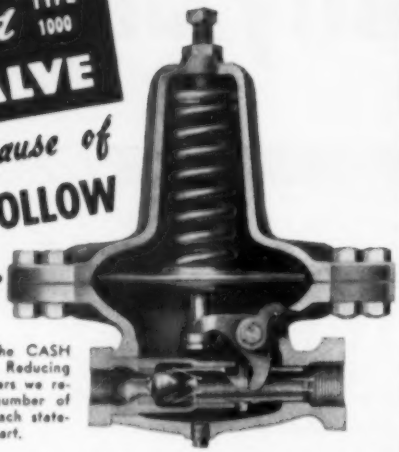
The "MILLION STROKE" Grease

TROUBLEMAKERS . . . CHECKED OUT OF PLANTS USING THE

CASH STANDARD *Streamlined* PRESSURE REDUCING VALVE TYPE 1000

. . . . it's done because of

BENEFITS THAT FOLLOW INSTALLATION . . .



Below is shown 10 benefits obtainable with the CASH STANDARD Type "1000" Streamlined Pressure Reducing Valve. Statements from a few of the many letters we receive from users are listed. Each gives the number of benefits realized. Check the letter preceding each statement against the corresponding letters in the chart.

A A Maintenance Engineer checks 7 of the points and says, "We have experienced excellent results."

B A Tire Company in checking 10 points says, "We wouldn't hesitate a minute in recommending the '1000'."

C A Maintenance Engineer checks 10 of the points and says, "We use the '1000' under very adverse conditions and find it perfect in every way."

D A Mill Supply Company checks 6 of the points and says, "Said valves can be throttled to practically zero from pressure set at."

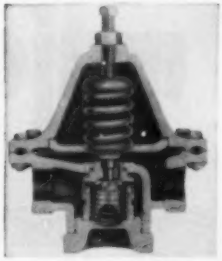
E A Manufacturer checks 7 of the points and says, "We have found the '1000' to be a very good pressure controller in every way."

F A Maintenance Engineer checks 8 of the points and says, "If we had more places to use Type '1000' I would insist on using them."

A B C D E	**POINT No. 1** Maximum capacity when needed most.
A B C D E F	**POINT No. 2** Accurate pressure control under toughest working conditions.
A B C E F	**POINT No. 3** Trouble-free service.
A B C D E F	**POINT No. 4** Smooth operation.
B C E F	**POINT No. 5** Tight closure.
B C D	**POINT No. 6** Speedier production results.
A B C E F	**POINT No. 7** Elimination of failures.
B C D F	**POINT No. 8** Cost-saving operation.
A B C F	**POINT No. 9** No spoilage.
A B C D E F	**POINT No. 10** Practically zero in maintenance.

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.

Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

CASH STANDARD CONTROLS.. VALVES

Send FOR BULLETIN 962

A. W. CASH COMPANY

DECATUR, ILLINOIS

ERIEZ

MAGNETIC AGE

Issued periodically in Erie, Pennsylvania, by the Eriez Manufacturing Company, Producers of Magnetic Equipment.

ERIEZ MAGNETIC PIPELINE TRAP SEPARATES IRON EFFECTIVELY

Efficient, economical protection against the passage of tramp iron through pipelines which convey liquids is afforded by the Eriez Permanent Magnetic Pipeline Trap. The device prevents damage to processing equipment or

contamination of product by removing stray iron from materials conveyed in the pipes.

The trap is simply constructed. It consists of a cast stainless steel housing and a specially designed permanent magnet element. There are no moving parts.

Stray ferrous material in liquids is caught by the powerful permanent-duty magnet. Cleaning is accomplished by simply removing a face plate; the trap remains in the line.

Available in 2", 2½", 3" and 4" diameters, with threaded ends. The separator withstands pressures up to 75 psi.

For more data on pipeline traps circle No. 4 in coupon and mail to Eriez.

INTERNATIONAL HARVESTER PLANT ENGINEER PRAISES ERIEZ MAGNETIC SEPARATOR

At the Indianapolis Works of the International Harvester Company, an Eriez Permanent Magnetic Pulley is used to separate usable shot from fines in a Pangborn shot blasting machine. The plant engineer reports excellent results.

The unit is separating minute particles of ferrous from non-ferrous material by the use of strong, specially designed Alnico permanent magnets.

The Eriez pulley is 12" in diameter and is inserted in a 12" belt width line. Magnetized

bars run lengthwise of the pulley and create a magnetic field through the belt. The non-magnetic material falls off the belt as it passes the tangent point of the pulley, while the magnetic shot clings to the belt until it is carried out of the magnetic field.

Newly designed 1950 Eriez Magnetic Pulleys are up to 50% stronger. To learn more about these effective separators, circle No. 5 in the coupon and mail to Eriez.

MAGNET CATCHES TRAMP IRON UNDER HIGH HEAT CONDITIONS

An Eriez Plate Magnet installed on a conveyor line at Trico Products, Buffalo, N. Y., is successfully separating tramp iron from scrap zinc despite its exposure to the radiant heat of an adjacent metal-melting furnace.

The fact that the Eriez product utilizes permanent, non-electric Alnico magnets is an important reason for the constant protection afforded Trico under these conditions. No depreciation of magnetism has been observed.

An Eriez Giant magnet is the type used. This is the most powerful model produced commercially. It is used effectively to remove tramp iron and steel from heavy flows of sand, coal, metal, rock products, etc., and for purifying liquids or slurries passing over the separator.

More information about Eriez plate magnets for industry can be obtained by circling No. 6 in the coupon and mailing.

NEW ERIEZ ROTARY MAGNETS SWEEP FLOORS, RETRIEVE PARTS

A low-cost permanent magnetic device for sweeping up or retrieving ferrous material from floors, parking lots, plating tanks, etc., is now being marketed by the Eriez Mfg. Co. These lightweight rotary magnets offer maximum pick-up capacity because the magnetic tube rotates through a full 360° and thereby presents the greatest possible surface area for collection.

Two types are manufactured, floor and tank magnets. The floor magnet has proved invaluable in cleaning up factory floors, driveways, parking lots and other areas. It operates just like a carpet sweeper, with the magnetic tube mounted between Neoprene wheels. Ferrous material literally jumps to the magnet and spreads itself over the entire circumference to a thickness of about ¾". Unloading is accomplished at either end by simply pushing the wiper ring from one end of the tube to the other, where a non-magnetic section causes the load to be released. Several sizes are available.

The tank magnet is extremely useful in removing metal parts or contamination from alkali baths, plating tanks, etc. Design is similar to that of the floor magnet except stainless steel is used in its fabrication to make it acid-proof and alkali-proof. Two different sizes are manufactured.

Prices on the Eriez Rotary Magnets range from $26.50 to $53.50 depending upon model and size. For more information circle No. 3 in coupon and mail to Eriez.

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204 State Street, Erie, Pa.

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Company Name

Street

City and State

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Most Practical PIPE WRENCH

ROXCO

it's individually

REGISTERED

it's completely

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TRIMO-ALLOY WRENCH . . . Roxco's only Rival . . . an all alloy-steel heavy duty pipe wrench long famous for ruggedness. Different in design, but has power comparable to Roxco.

it's superiority for yourself!

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Buy one "Registered" Roxco and use it for your toughest jobs. If you don't agree it stands up better . . . is handier, faster to use . . . is a bigger value than any pipe wrench you've ever used . . . return *that one* trial Roxco direct to us (not the seller), within sixty days with a note of price paid and reason for returning. We will refund your money. This get-acquainted offer good until Dec. 31, 1950. Trimont Mfg. Co., Roxbury, Mass.

EVER TO COME ON THE MARKET

Combine Maximum Strength with Minimum Weight

Here, at last, is a pipe wrench that's a brute for strength, yet a beauty to handle.

No longer is there any need to tolerate useless weight in order to get dependable strength. Through stress analysis during design, useless metal that means tiring weight was engineered out of the new *Roxco*. Extra metal, exactly where needed for extra strength, was engineered in.

The lighter, handier, faster-working *Roxco* actually exceeds by a good margin the strength requirements of Federal Spec's. for Heavy Duty Pipe Wrenches, Type II, GGG-W-651a.

In many other ways, too, *Roxco* is the most practical pipe wrench ever known. Read all its superior features . . . the ratcheting action that matches any man's speed . . . the tough jaws with induction hardened teeth . . . the unique reinforcing shoulder behind insert jaw . . . and all the others. Get a trial *Roxco* . . . judge it on the job. It's made in sizes 6" to 48". No gamble because every wrench is . . .

Individually REGISTERED . . . Completely GUARANTEED

Special design and quality control enable us to back the *Roxco* to the fullest extent. Every wrench is given its own serial number and fully guaranteed . . . *every* part of it . . . against breakage in any normal heavy duty use.

✓Check these "engineered" features

1 Extra Strength Based on Stress Analysis: Extra metal at critical points provides much higher resistance to failure. Withstands unusual stress in "side pull".

2 Lighter Weight Achieved: Stress analysis showed where useless metal could be eliminated to produce a lighter, handier wrench.

3 Uniform Jaw Hardness and Strength: Both jaws are drop-forged alloy steel. Teeth are hardened by automatically-timed, localized induction process at wear points, yet tough core of jaws is retained for strength.

4 Reinforcing Shoulder Behind Insert Jaw resists unusual stress. Assures long, trouble-free service.

5 Rapid Ratcheting Action: New, simplified cushion action replaces complicated spring. With Roxco tooth design, it prevents seizure on pipe and permits fast ratcheting — as fast as user can move his hand. Accurate fit of parts saves lost motion — speeds jobs.

6 Comfort-Shaped, Palm-Fitting Handle: New wider, more comfortable handle — makes work easier, cuts worker fatigue.

7 Reinforced Housing embodies a hammer face to break cast fittings.

8 Handy, Accurate Pipe Scale permits quick adjustment to desired size.

Special Metallurgical Formula: Roxco Metal, combined with scientific heat treating, means superior strength throughout.

AMAZING TEST OF STRENGTH

4510 LBS. of automobile and rigging was suspended from the handle of a stock 24" ROXCO gripped on a steel shaft. No distortion when the load was removed—the wrench was 100% perfect throughout!

Plant Engineers' Digest

Rust-Preventive Properties for Antifriction Bearings

IN MANY industrial applications, contamination of the lubricant with water, either by condensation or the ingress of water through bearing seals, is a common occurrence.

The consumer of lubricants often regards sodium-base greases, in general, as having poor water-resistant properties whereas those prepared from calcium, aluminum, lithium, and barium soaps are looked upon as water resistant. Extreme care must be exercised in formulating conclusions in this connection, because some sodium-base greases are quite water resistant insofar as the formation of oil-in-water dispersions are concerned. To illustrate this fact, it might be pointed out that sodium-base greases are normally satisfactorily employed in the antifriction bearings of car and truck wheels, which are subjected to wet driving conditions through rain and snow.

If a grease shows a marked tendency to form an oil-in-water emulsion when contacted with water, it will usually be readily washed from an antifriction bearing, particularly if the water is warm. On the other hand, if the grease absorbs water to a marked degree to form a water-in-oil dispersion, the volume of lubricant may increase to the point where leakage thereof will be excessive.

Generally speaking, the only greases which tend to wash out of bearings to form oil-in-water emulsions are conventional sodium-base lubricants. This tendency is less marked the higher the viscosity of the mineral oil. Calcium, aluminum, lithium, and barium-base greases, and sodium-base greases, prepared from relatively high-viscosity mineral oils, may absorb water to form water-in-oil dispersions. The amount of water which will be taken up by a grease will be dependent not only upon the composition of the product but also upon the degree of homogenization to which the lubricant and water are subjected.

From the foregoing comments it will be apparent that the resistance which a grease in an antifriction bearing exhibits to displacement by water is dependent upon a number of factors. The most important of these factors are as follows: 1 metallic component of soap (sodium, calcium, etc.); 2 fatty component of soap (oleate, stearate, etc.); 3 mineral oil (viscosity, degree of refinement, etc.); 4 reaction of finished grease (free acid or alkali); 5 additives (rust and oxidation inhibitors, etc.); 6 bearing design (seals, etc.); 7 operating conditions (temperature, speed, etc.).

Rust Preventive — Experience has shown that if the grease is to satisfy the objectives of water resistance and rust prevention, some compromise may be necessary because improved rust-preventive properties are usually obtained by favoring the factors which tend to encourage emulsification of oil in water. It has been generally observed that the lubricant, to be an effective rust preventive, must contain a component which will preferentially wet the bearing surfaces in the presence of moisture and/or promote the formation of the required type of emulsion.

Generally speaking, highly water-resistant greases will show poor rust-preventive characteristics when water is present. Soda-base greases usually have good rust-preventive properties, but, obviously, if the water solubility of the product is high, it may be washed entirely from the bearing and not be present to protect metallic surfaces against the corrosive action of water. Rust-preventive properties of greases definitely are tied in with composition, and the properties of greases in this respect may be markedly modified through the addition of small amounts of surface-active rust-preventive materials. *From Paper No. 49-A-52 by E. S. Carmichael and R. C. Robinson on Characteristics of Greases as Related to Antifriction Bearing Applications presented at Annual Meeting of The American Society of Mechanical Engineers.*

Use Double Care When Defrosting

FROZEN FOODS valued at $80,000 were placed in danger of contamination by ammonia when an explosion occurred in the holding room of a cold storage warehouse. A tank containing liquid ammonia exploded and its contents were blown into the room. The tank served as an ammonia accumulator and was connected in the line leading to cooling coils used to maintain subzero temperatures in the room.

One of the operators reported that the holding room coils were being defrosted when the accident occurred. He had shut off the valves in the liquid and suction lines and had turned on the cold water spray provided for the purpose of melting the frost from the coils. After he had checked the water flow of the spray equipment, he left the room and had just closed the door when it was blasted open by the explosion.

The accumulator tank ripped open for the entire length of its welded

Safety Weather or Not

ONE GOOD TURN DESERVES ANOTHER WORK SAFELY
DO NOT LET AN ACCIDENT SPOIL YOUR TURN TODAY
SAFETY RECORD
JOLIET WORKS
WALK ON LEFT

Here is a new twist in safety signs. Perched atop the bulletin board is a weather vane with a message. The four-bladed propeller is painted a bright red with a white stripe on each blade. The weather vane message ties in with the stationary signs on the bulletin board. (From Wireco Life, Mar. 1950, a publication of The American Steel & Wire Co., Cleveland, Ohio.)

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Ask any user . . . you'll find them everywhere

In scores of industries, users of Wickwire Rope have developed an affectionate respect for its performance, safety and long life. And, for true economy, they use Wickwire's WISSCOLAY® Preformed. It lasts longer — is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Rope Sales Office and Plant — Palmer, Mass.

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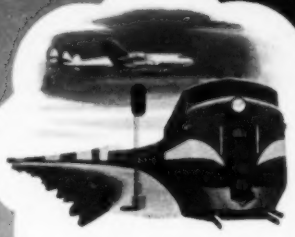
LOGGING

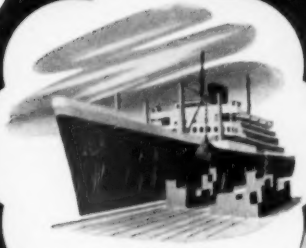


TRANSPORTATION

MINING

PETROLEUM

MANUFACTURING



MARINE

CONSTRUCTION

longitudinal seam, and the tear extended several inches into the flanges of both heads of the vessel. The cause of the explosion was overpressure. As a result of the warmth of the defrosting spray at 60 F, the liquid in the cooling coils boiled and pressure built up in the accumulator. There was no relief valve on the tank, which had been isolated from relief valves in other parts of the system when the valves in the liquid and suction lines were closed.

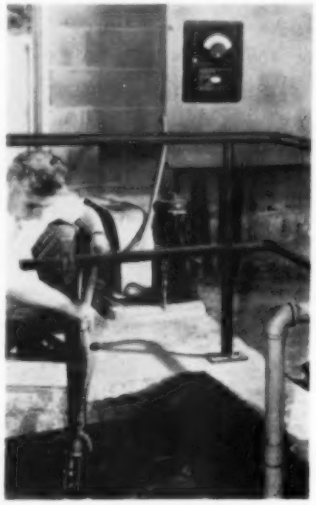
Many accidents to refrigerating systems occur during the defrosting process. Such accidents range from explosions to cases where a pipe is broken while frost is being knocked or chipped from the coils with a hammer or other tool. Extreme care should be the watchword during the defrosting process. *From The Locomotive, Jan. 1950, a publication of The Hartford Steam Boiler Inspection and Insurance Company, Hartford 2, Conn.*

Treatment of Waste Pickle Liquor

PURIFICATION of waste pickle liquor is a vital factor in the modern steel plant where local laws often require treatment to prevent stream pollution. Measurement and control of pH with the Brown-Beckman system outlined herein offers the ideal method for accomplishing this treatment automatically, providing a continuous chart record which proves that the neutralized liquor is held within the specified tolerances.

The pH control system operates as follows: Waste pickle liquor from a storage tank flows through a gate valve (normally open) to the treatment basin. Here the liquor is aerated to oxidize all ferrous iron to the ferric condition while caustic soda is added to neutralize all acids. Vigorous agitation is employed to accelerate the chemical reaction.

The pH of the neutralized waste is measured by an electrode assembly located at the effluent end of the basin. The pH value is recorded by a potentiometer, which accordingly governs air pressure on the control valve in the caustic soda supply line to maintain the pH of the neutralized liquor at the desired value.



A pH amplifier and immersion electrode assembly unit are being used at the effluent end of the treatment basin

Because neither the pH nor the flow of waste liquor is constant, the controller incorporates proportional plus reset control to compensate for these variables. The resulting precise control holds pH of the treated liquor at the proper value regardless of the normal, unavoidable process fluctuations.

From the treatment basin, the waste flows to the settling basin. Here the sludge settles out, being collected and disposed of separately; while the clarified and neutralized waste is delivered, harmless, to the river. *From Instrumentation, Vol. 4, No. 2, a publication of Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Philadelphia 44, Pa.*

Prevent Explosion Hazards in Industry

RESEARCH and developments in the chemical industry during the last thirty years has filled industrial plants with sources, not only of air contaminants, but with serious hazards to life and property. Flammable liquids and gases create fume- and vapor-air mixtures that are highly explosive. In addition, many dust laden atmospheres are potential explosion hazards.

The problem of the electrical engineer is to use precautionary measures that will prevent explosions and fires from electrical causes, such as arcing, sparking, overheating and static discharges.

The ability of a flammable liquid to form explosive mixtures is determined

Business is on the Move

BUSINESS is being conducted on wheels these days. Need for mobile offices and tool houses was apparent when Fluor Corp. was awarded a contract to construct an absorption plant near Taft, Calif. The oil field was a new one, located about 43 miles from the town, and the housing of office personnel and small equipment in that desert area presented a problem. The problem was finally solved by the use of mobile trailer units.

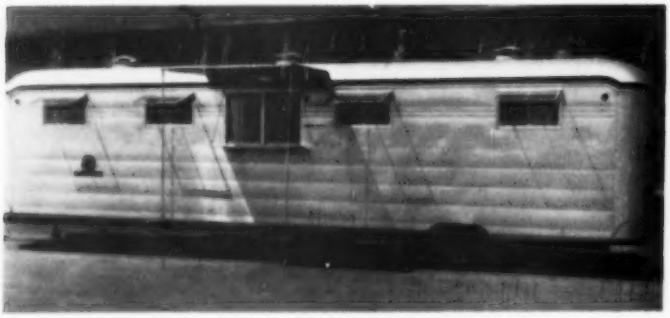
There are now three types of trailers utilized in field construction—office trailers, tool houses, and combination office and tool houses.

The spacious office trailers are 8 by 32 ft in size, with a 7-ft ceiling. Entrances lead into three separate compartments, which contain a total of five desks and chairs. Two built-in seats cover the wheel wells. The large center office also contains two three-drawer file cabinets—and there is still ample room for three people to keep records on 300 men.

Lighting is provided through a 100 volt circuit and nine windows equipped with Venetian blinds for light control. Telephone outlets can be connected whenever the trailers are stationary.

Because they are sometimes used in areas having extreme weather conditions, the trailers have air-conditioning systems that help maintain moderate temperatures. In the desert, the wheels are set into the earth and sand is piled around the sides. From beneath the unit, a fan blows air through water soaked cloth, where it is drawn up through transoms in the floor by three exhaust fans in the ceiling.

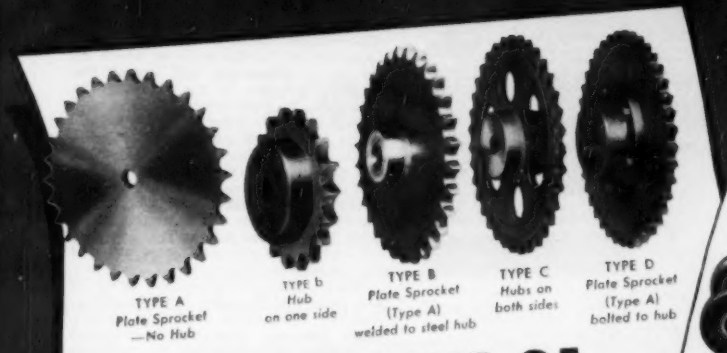
Portable electric heaters keep occupants warm during the winter months. Insulation between the aluminum body and the plywood siding helps with heating and cooling problems. *From Fluor-O-Scope, Feb. 1950, a publication of The Fluor Corp., Ltd., Los Angeles 22, Calif.*



Built of sheet aluminum, office trailers are light in weight for easy pulling. They help bring the necessary paper work directly to the field, speeding operations

Tool house trailer is readied for the road as warehouseman loads and checks

AVAILABLE FROM STOCK



TYPE A
Plate Sprocket
—No Hub

TYPE b
Hub
on one side

TYPE B
Plate Sprocket
(Type A)
welded to steel hub

TYPE C
Hubs on
both sides

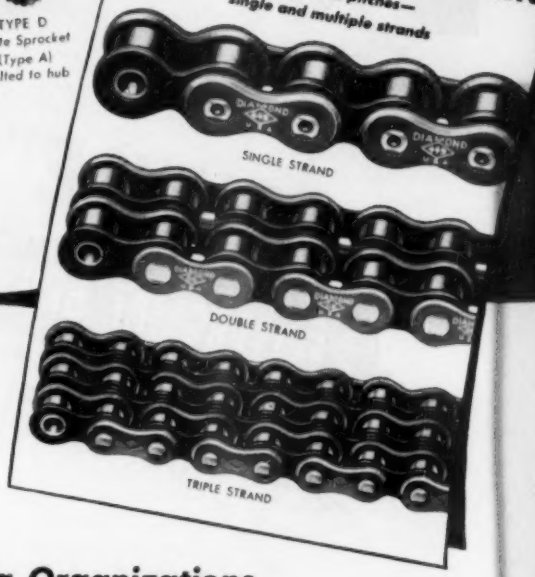
TYPE D
Plate Sprocket
(Type A)
bolted to hub

A LARGER LINE OF DIAMOND STOCK SPROCKETS

For single and multiple strand chains

COMPLETE STOCK OF DIAMOND ROLLER CHAIN

All standard pitches—
single and multiple strands



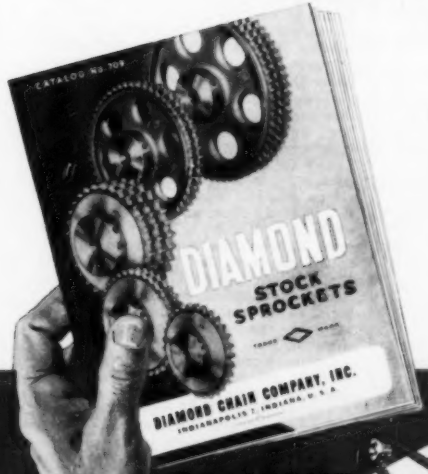
SINGLE STRAND

DOUBLE STRAND

TRIPLE STRAND

STOCKED FOR IMMEDIATE DELIVERY BY

Established Distributing Organizations in All Industrial Centers



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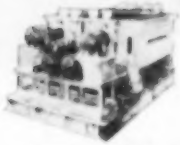


Typical of the equipment designed and built for the metal working and metal finishing industries by the W. S. Rockwell Company of Fairfield, Connecticut is the Rockwell Brush Box, used in connection with a continuous strip anneal and pickle line to produce a clean, bright finish on brass strip. Into this machine Rockwell engineers have built four power-driven Fullergript brushes. The brush material is stainless steel wire anchored in a stainless steel backing strip to withstand the corrosive effect of the pickling or cleaning solution. The brush assemblies are mounted on cone type stainless steel self-centering couples for quick and easy removal of the brushes. The same set-up can be used for dry brushing metals that have a very light film of dirt or very light oxide not requiring a pickle.

Fullergript power brushes offer similar production economies in a wide variety of industries. It will pay you to investigate the possibilities of Fullergript for your own plant. Simply write to:

THE FULLER BRUSH COMPANY

INDUSTRIAL DIVISION, 3637 MAIN ST., HARTFORD 2, CONN.

largely by its vapor pressure, volatility, or rate of evaporation. The important items to be determined in hazardous gas- and vapor-air mixture locations are: 1. At what temperature will ignition take place? 2. At what mixture-ratio do the gases reach an explosive state? 3. How rapid is the pressure rise in concentration? 4. What is the optimum concentration in a closed space? (Assumed to be the point at which all the gas in suspension will use all the available oxygen in the mixture. At this point the maximum pressure and rate of rise will occur.)

The intensity of a dust explosion depends upon: 1. The chemical and thermal properties of the dust. 2. The size and shape of the particles. 3. The concentration and degree of dispersion of the dust in the air. 4. The proportion of inert dust in the air. 5. The moisture content. 6. The size and temperature of the ignition source.

Many flammable gases are more or less toxic and thus involve a health as well as a fire and explosion hazard. More effective ventilation is required to reduce concentrations of injurious vapors to a safe breathing point than needed to reduce the mixture to the non-explosive point.

The fundamental requirements for electrical equipment operation in both the hazardous gas- or vapor-air mixture and the dust atmosphere should be considered. For gas- or vapor-air mixture, it is important to prevent the flames which may be ignited in equipment and wiring raceway enclosures from passing outside to the surrounding atmosphere. For dust atmosphere, dust-tight enclosing cases for both equipment and wiring raceways should be designed to limit the possible accumulation of dust and prevent the ignition of the dust on or adjacent to the equipment. *From a paper by Kennard Pinder, DuPont, in a release of American Institute of Electrical Engineers.*

New Paint Applied by Heating

A SWEDISH manufacturer of paint and painting equipment is here in the United States to negotiate a license agreement to market a special type of paint and, equally important, a new method of application. The process, named Antrophal—that is, the combination of an anti-corrosion paint and the technique—creates a protective coating which has been tested under conditions equivalent to 15 years of actual exposure.

Key to the system is a paint which contains no solvents but consists of resins, oils and waxes. In its cold state it is a waxy mass and, for application, must be melted by a heater in a spray gun. Between the gun and the surface to be covered the paint is sprayed through a flame. This mixture, so heated and applied, bonds with the material of the steel or other surface immediately to form a coating, hard and durable.

Ordinary paints develop surface pores as their solvents evaporate but, under the new system, these have no opportunity to form. Unlike other methods, moreover, climate and season have no influence on the results of the application. If the surface to be coated is

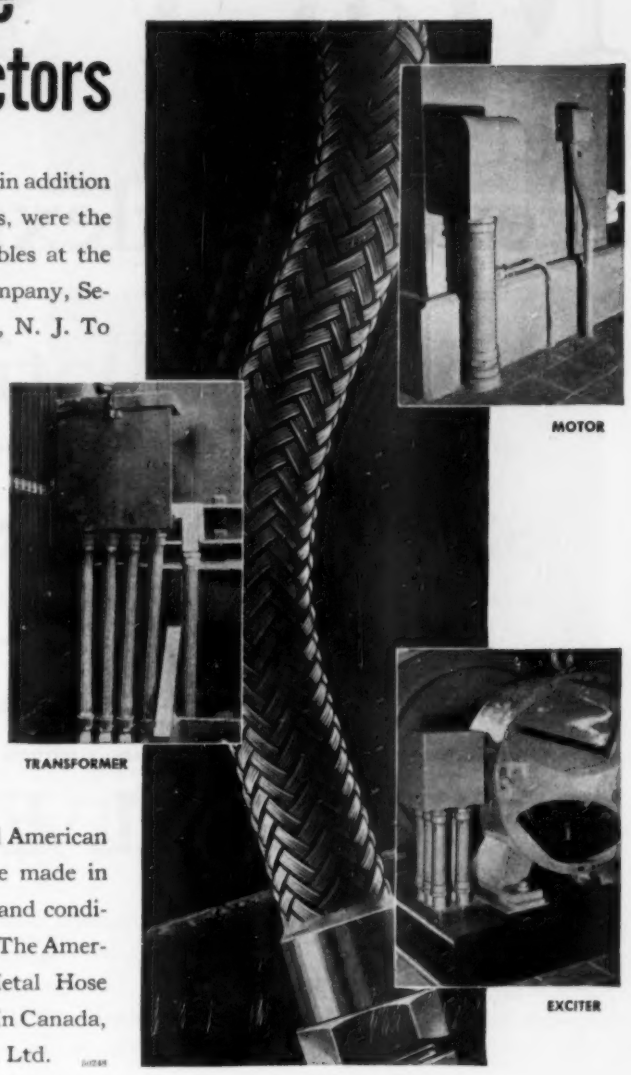
(Continued on page 26)

Generating Station "Makes Ends Meet" with Flexible Connectors

Moisture and mechanical protection, in addition to flexibility at terminal connections, were the primary considerations for some cables at the Public Service Electric and Gas Company, Sewaren Generating Station, Sewaren, N. J. To meet these requirements American Seamless Flexible Metal Tubing was chosen by the design engineers of this utility.

American "Seamless," in addition to being 100% water-tight, has several "plus" advantages. Alignment ease at rotating units, junction boxes and other equipment simplifies on-the-job installation. Savings in construction costs are an added premium obtained along with the flexible connection provided.

American Flexible Metal Hose and American Seamless Flexible Metal Tubing are made in types for a wide variety of services and conditions. For information, please address The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada, The Canadian Fairbanks-Morse Co., Ltd.



MOTOR

TRANSFORMER

EXCITER

ANACONDA

wherever connectors must move . . . ***American***

FLEXIBLE METAL HOSE AND TUBING

Macy's*

San Francisco

gets extreme flexibility

to handle load changes and future load growth

low installation cost

everything was shipped complete—as a unit—and easily installed

safety to personnel

no exposed circuits; metal encloses all current-carrying parts

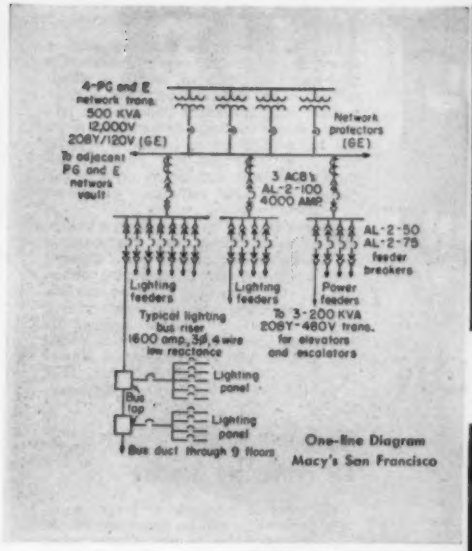
plenty of "IC"....with

100,000 amperes interrupting capacity, adequate to handle all short circuits

GENERAL ELECTRIC

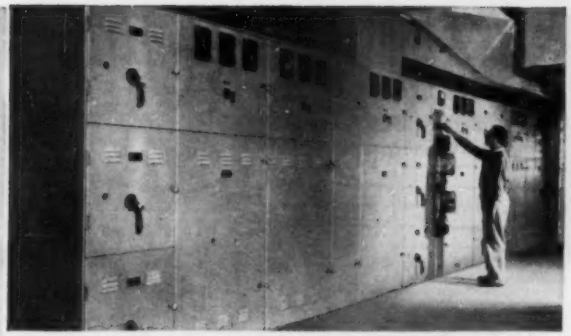
HERE'S WHY . . . "In the department store business we cannot take any chances with power outages or potential fire hazards. We must also plan for expansion. That's why we wanted our power distribution system to be safe, to have adequate feeder and branch-circuit capacity, plus flexibility. General Electric switchgear gave us all these requirements."

E. L. MOLLOY, VICE PRESIDENT
MACY'S, SAN FRANCISCO

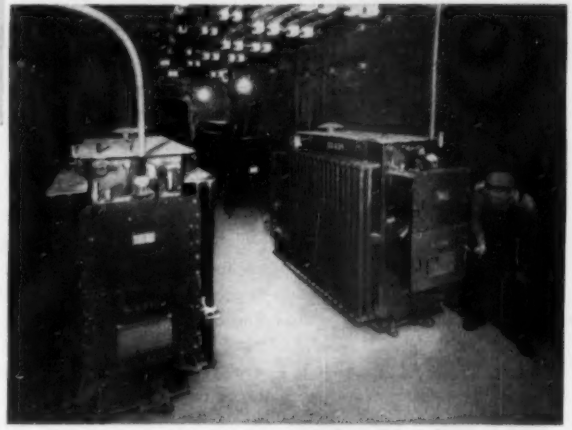


This, the largest switchgear installation to date in any San Francisco commercial building, adequately handles the power requirements that average four watts per square foot (nearly 500,000 square feet). Flexibility of the feeder system permits load changes without increasing the load on the switchgear. The 4000-ampere breakers have induction relay tripping.

Macy's installation is a complete General Electric project—switchgear, three 200-kva transformers for elevators and escalators, power and lighting panels, motors, and control for ventilating and boiler-room auxiliaries. One source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.



G-E metal-enclosed switchgear handles the incoming 120/208-volt power. The equipment is divided into three sections, two for lighting, one for power. Breakers (cascaded) are of the drawout type for ease of inspection and maintenance.



Four G-E network units, rated 500 kva, 12,000-120/208 volts in a Pacific Gas and Electric Company vault serve the building. Macy's 2500-kva load represents one of the largest loads added to PG&E's downtown network in recent years.

low-voltage SWITCHGEAR

Modern industrial power distribution systems using G-E switchgear are applicable to any industrial plant or commercial building where you want proper voltage for top performance of equipment, an extremely flexible setup to take care of expanding or changing loads, adequate short circuit protection, safety to personnel, and low installation and maintenance costs.

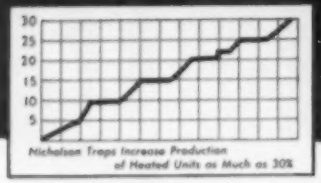
Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

Investigate today the many advantages of using General Electric switchgear in *your* plant for efficient, flexible power distribution. Contact your G-E sales representative for further information—and write for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

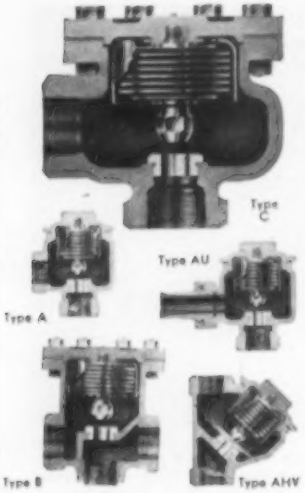
GEA-4966 Low-voltage Switchgear
GEA-3642 Air Circuit Breakers
GEA-2017 Network Protectors
GEA-3083 Metal-clad Switchgear
GEA-3592 Load-center Substations
GEA-3758 Load-center Distribution

GENERAL ELECTRIC

PLANT TESTS SHOW
NICHOLSON TRAPS
Raise
PRODUCTION



Leading Processor
SHORTENS OPERATION
from 65 to 45 Min.



Records of a recent installation of Nicholson steam traps, by a leading food packer, show they cut cooking time 30%. For example, one operation was shortened from 65 to 45 minutes. Nicholson units keep equipment full of live steam because: 1) operate on lowest temperature differential; 2) have 2 to 6 times average drainage capacity. Also record low for steam waste; and maximum air-venting capacity. Widely specified for preventing damage to thin gauges of heat transfer units; eliminate cold blow in unit heaters.

5 Types for Every Plant Application:

process, heat, power. Size ¼" to 2"; pressures to 225 lbs. Nicholson trap catalog is a standard reference on drainage methods. Send for **CATALOG No. 250.**

W. H. NICHOLSON & CO.
208 Oregon St., Wilkes-Barre, Pa.

NICHOLSON Traps
THERMOSTATIC ▼ PISTON AND WEIGHT-OPERATED STEAM
GASOLINE AND COMPRESSED AIR TRAPS ▼▼▼
CONTROL VALVES ▼ FLOATS ▼ MANDRELS ▼ STEAM AND AIR SEPARATORS

(Continued from page 22)

damp, the flame dries it as the paint is sprayed, and if the coat subsequently is chipped or damaged, any rust which forms on the exposed portions is prevented from spreading beneath the adjacent intact coating. Already tested on the hulls of ships in northern waters, this new technique has replaced the initial red lead anti-corrosion and the anti-fouling layer commonly employed in marine practice.

As evidence of its durability, a bridge at Hufingen, Germany, was painted during the winter of 1936 when covered with ice and snow. A recent inspection showed the Antropahl coated surface to be fresh and nearly altogether free from rust, whereas those covered by two other kinds of paint were corroded and rust packed. *From Central Manufacturing District Magazine, Jan. 1950, a publication of the Central Manufacturing District, Chicago 3, Ill.*

Aluminum Paints for Protective Coating

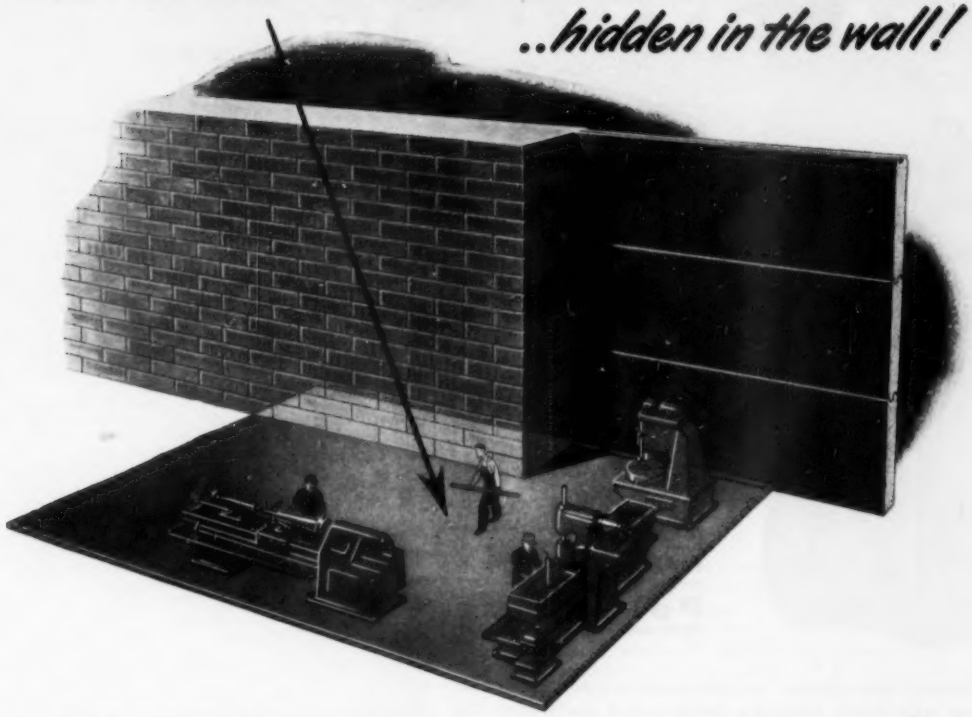
FINISHES OF products or large industrial structures can be protected by the use of aluminum paints. These paints offer such advantages as high durability, moisture resistance, reflectivity for light and radiant heat, unequalled hiding power, ability to retard the bleeding of oil-soluble stains, and quick drying.

Aluminum paints may be applied by brushing, spraying, or dipping. Stippling can be used to achieve interesting decorative effects. Depending on formulation, these paints may be applied to a wide variety of surfaces, including metal, brick, concrete, wood and cloth. It has been applied to oil tanks, bridges, corrugated siding, roofs, water towers, and virtually anywhere else a durable corrosion-resistant coating is required.

Aluminum paint also protects surfaces against moisture in dairies, laundries, refrigerating rooms, ice plants,

Aluminum paint applied to storage tanks for gasoline, oil products, and chemicals reflects the radiant energy in sunshine and minimizes loss by evaporation or by some chemical change

FOUND 602 sq. ft. of floor space ..hidden in the wall!



It was a small plant Mr. Williams was building—150′ x 250′. Instead of the usual 12″ thick wall of brick, an alert young engineer suggested the new 3″-thick, insulated Fenestra* "C" Panels he'd heard so much about. Same function . . . same insulating value . . . same outside building dimensions. But *inside*—602 sq. ft. more floor space than he'd have had with the old-style wall. Floor area equal to a 20′ x 30′ room.

He also discovered:

That the installation speed of these panels cut construction costs . . . helped get equipment under cover quickly.

That they are lightweight, strong . . . reducing requirements for structural steel.

That they are noncombustible.

That they are good-looking and so smooth that dirt and grease can't get a grip.

And he *will* discover, when he wants to expand, that they are easily dismantled, moved and reinstalled.

Fenestra Insulated "C" Panels are standardized 3″ deep, 16″ wide, 18 gage painted steel or 16 B&S gage aluminum, 6′ to 14′ in length. Those of steel weigh only 6.50 lbs. per sq. ft. Aluminum, 3 lbs. Two formed members, joined to form a structural unit. Asphaltic impregnated felt inside full length of the joints to prevent metal-to-metal contact. Vapor-sealed, with felt stripping between formed sides and end closures. Double tongue and groove joints make a wall of "C" Panels an integral load-bearing unit. 3 positive bearing surfaces per panel for easy erection. Smooth surface permits easy flashing details.

Check into Fenestra "C" Panels right away . . . they save you time, money and *won't* waste floor space.

Mail the coupon, or have one of our engineering representatives call. Also ask about "D" Panels for floors and ceilings, and Holorib Roof Deck. *Trademark

Fenestra

Panels • Windows • Doors

"Use Our 25 Years' Experience in Metal Panel Engineering"

DETROIT STEEL PRODUCTS COMPANY
Building Panels Division
Dept. PE-5, 2280 E. Grand Boulevard
Detroit 11, Michigan

Please send me, without obligation, information on Fenestra Building Panels.

Name _____

Company _____

Address _____

Designed for

Longer-Life Performance

Jefferson Power Circuit Transformers are constructed of heavy gauge metal with sturdy mounting brackets and easily accessible wiring compartments for both primary and secondary connections. Convenient ½" and ¾" knockouts help speed up installation and facilitate the splicing of connections. Air-cooled, they require no special vaults or enclosures.

With Jefferson Power Circuit Transformers providing the 115 or 230-volt service, wherever desired, only the higher voltage, lower-cost circuit need be installed throughout the plant. Specify Jefferson, the "Correctly Designed" transformer, in your new plant, or for your next rewiring job. Transformer Bulletin 461-PCT is yours for the asking.

Jefferson Transformers are of the dry type and may be mounted on wall, post, or directly on the machine to supply 115-230 volt current to lights, controls, relays and other small electric equipment.

JEFFERSON ELECTRIC COMPANY
Bellwood, Illinois

In Canada: Canadian Jefferson Electric Co., Ltd.
384 Pape Ave., Toronto, Ont.

Dry Type JEFFERSON ELECTRIC **Power Circuit**

TRANSFORMERS

deep freeze lockers, and other interiors subjected to high humidity conditions. The insulating action of this paint makes it ideal for use on hot surfaces, such as furnace jackets, hot air ducts, boilers and pipes. *From the Bakelite Review, a publication of the Bakelite Corp., New York 17, N. Y.*

Metal that Melts in your Hand

Do you know of any commercial uses for a costly, little-known metal which will melt when held in the hand? That is the problem facing the manufacturer of gallium, a by-product of the extraction of lead and zinc, and priced at $1300 a pound.

This metal has an extremely low melting point of 85 F. As it is prepared for sale to laboratories it is in the form of metallic crystals of a distinctive thickened leaf shape. At ordinary summer temperature these will melt into a silvery liquid if not refrigerated. Because of this, the cold storage method is necessary to keep the material in a constant form.

Since interior body temperature is 98.6 deg, gallium is readily melted by body heat. When a piece of it is held in the clenched hand there is a distinctly cold sensation as the material is warmed and begins to liquefy. Soon one edge gives way and the metal flows out between the fingers.

So far the most important work on potential uses is being done by the Navy. A radioactive isotopic form of one of the gallium salts has been injected into test animals and autoradiographs made of the animals' bones. These show that the material has the ability of going direct to the growth areas within the bones and concentrating there.

Research is being conducted by various laboratories to determine possible uses for this unique metal. *From a news release for Eagle-Picher Co., Cincinnati 1, Ohio.*

Dry Chemical Extinguisher Maintenance

RECENT FIELD experience and laboratory tests have shown that dry chemical used in extinguishers, though treated to prevent caking, may eventually lose its free-flowing properties under prolonged exposure to high humidity.

This suggests that dry chemical should be examined annually, and replaced with fresh chemical if caking is noted. The gas cartridge should also be weighed and replaced if it has lost more than 10 per cent net weight.

After use, a dry chemical extinguisher should be inverted and the excess gas pressure used to blow the discharge outlet clear. On recharging, make sure that the outlet is free of dry chemical.

Keep all extra chemicals in tightly sealed containers, preferably metal, and store in a dry location. Discard any which have become lumpy. *From Factory Mutual Record, Mar. 1950, a publication of Factory Mutual Engineering Div. of the Associated Factory Mutual Fire Insurance Companies, Boston 10, Mass.*

(Turn to page 30)

How to Make Buildings *Lighter and Stronger*

with PLEXIGLAS

Problem: How to add a second tier to this giant pressbox without reinforcing the whole foundation—or creating a safety hazard. *Solution:* Shatter-resistant PLEXIGLAS glazings. To safeguard spectators below, the Los Angeles Coliseum Commission approved the use of PLEXIGLAS in this application. And PLEXIGLAS *cut in half* the dead weight of almost solid rows of glass panes.

In today's large-area windows, strength-without-weight makes PLEXIGLAS invaluable. But *other* features suit it to *many* architectural needs. Easy workability means ready forming and fabrication of curved panels, partitions and ornaments. Resistance to age, weather, discoloration and breakage puts a low ceiling over maintenance costs. And a wide range of patterns and glowing colors, transparent, translucent or opaque, permits almost endless variety in architectural design.

Luminous ceilings and walls, fixed or movable partitions, lighting fixtures, store fronts and building facades—all are being constructed of PLEXIGLAS today. For full details of this adaptable acrylic plastic, write for your copy of our new booklet, "PLEXIGLAS for Architecture". It gives complete technical data, shows applications, suggests uses. And it's yours for the asking.

PLEXIGLAS *is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries.*

Canadian Distributor:
Crystal Glass & Plastics, Ltd., 282 St. Helens Avenue, Toronto, Ont.

PLEXIGLAS Panes *In*—
Growing Pains *Out*

Two tiers of PLEXIGLAS panes weigh less than a single tier of the original glass panes in the Los Angeles Coliseum's king-size pressbox. Saving in weight through use of this true *outdoor plastic* made it possible to add the second tier without reinforcing the foundations. Mounted at a 15° angle, the crystal-clear acrylic panels—as large as 68" x 80"—can be raised and lowered easily because of their light weight. And optical clarity means vision without distortion. Architects: Bennett & Bennett, Los Angeles, California. Fabricator: Artefex, Inc., N. Hollywood, California.

FREE—SEND FOR OUR LATEST BOOKLET about PLEXIGLAS as an architectural material. It's a mine of architectural data and suggestions.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

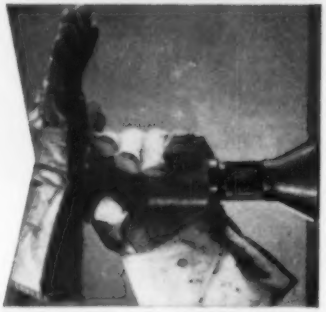
Representatives in principal foreign countries

READY!

Takes less than 30 seconds to prepare RAMSET TOOL with power charge and choice of 65 coated steel fasteners.

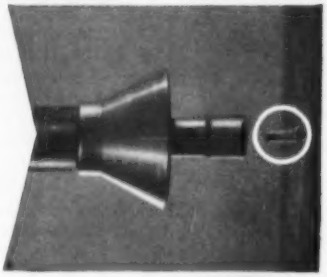
RAM!

Place light, compact tool against work, locating fastening point as accurately as desired. Then tap lightly and the fastener is . . .



SET!

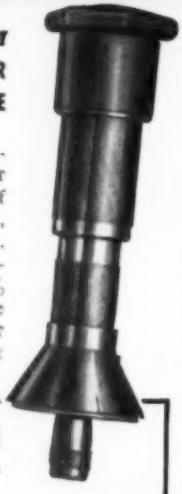
Instantly, tightly, cleanly, easily. No drilling, chipping or plugging. Less than a minute from start to finish.



FAST . . . RELIABLE *RAMSET SYSTEM* SLASHES COSTS . . . AND TIME . . . FOR FASTENING INTO STEEL AND CONCRETE

Every day, thousands of users are making startling economies in money and time with RAMSET FASTENING SYSTEM. For practically any kind of fastening jobs into steel, concrete, masonry, RAMSET does the work faster, better, cheaper.

Let us show you, by comparison with ordinary methods, how you can cut costs up to 60% and do your fastening work in ⅕ the time with the modern, reliable, proved RAMSET SYSTEM. Send for details and address of nearest RAMSET Specialist.



STEMCO CORPORATION
12117 Berea Road • Cleveland 11, Ohio
PIONEER IN POWDER-ACTUATED FASTENING

An Ounce of Prevention

A COMPANY in the East has organized a Workmen's Safety Inspection Committee which assists the safety department and the foremen in uncovering unsafe acts and unsafe conditions that often lead to serious lost-time accidents.

Members of the Inspection Committee are appointed by the general foreman on the first day of each month and after reporting to the safety department, where they are briefly instructed as to their duties and responsibilities, the inspection tour begins.

The committee inspects steel channel of a roller type fire door which has been damaged by a passing truck so that the door could not possibly close flush against the floor. The committee's report got action

Any condition that appears dangerous or contrary to safe operating procedures, is recorded, and at the end of the day the record is returned to the safety department where corrective measures are started at once. *From The Taylor Meteor, Jan. 1950, a publication of Taylor Instrument Companies, Rochester 1, N. Y.*

Proper Care of Wire Rope

SEVERAL suggestions are given here for getting the best service out of wire rope by proper care.

You should be careful to avoid kinking when unreeling or uncoiling wire rope, since kinking leads to early rope failure. Whenever possible, it is advisable to take the rope directly from the reel onto the drum, being sure to keep the same direction of bending, because reverse bending will injure the rope. A grooved drum is recommended, as it usually permits installation from one side and in one direction only.

If a smooth drum is used, care must be taken in spooling to avoid kinking, pressing or wedging, all of which shorten rope life. When wire rope is spooled on a smooth drum it tends to roll in the opposite direction from the lay—a right lay rope, for example, rolls to the left. For efficient spooling, a right lay rope spooling over the top of the drum should be started from left to right, while a left lay rope should be started from the right. This keeps the coils firmly together and gives

Beats the Heat!

New RUBBER-GLASS REPUBLIC CONVEYOR BELT

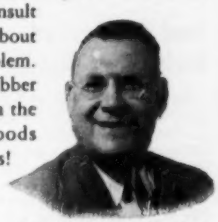
Solving problems is our business.

For example, this new Republic belt carries hot cargo for foundries. Red-hot pieces of jagged metal in tons of smoldering sand ride from shake-out racks to reclaiming stations on this rubber-glass belt. Temperatures often run as high as 400°F. and the work is continuous.

Operations like this meant only trouble until Republic Rubber and its Milwaukee Distributor, Shadbolt & Boyd Company, entered the picture. Life expectancy of ordinary "hot material" belts was just ten weeks and sometimes less.

Today, the trouble is over. Republic's new belt made of glass fabric and specially compounded rubber is on the job and, after more than a full year of continuous service, the belt rolls on. It's still pliable. The belt remains unbroken and good for a lot more service!

Success stories like this are common at Republic Rubber since we specialize in mechanical rubber goods only. An experienced Republic Distributor is located near you. Consult him or write us today about your most difficult problem. Remember, Republic Rubber has been *the* specialist in the mechanical rubber goods field for nearly fifty years!



Howard F St George, Vice Pres.
Shadbolt & Boyd Company
Milwaukee, Wis.

★ ★

Pioneers in the use of COLD RUBBER

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN, OHIO
Lee Deluxe Tires & Tubes · · Conshohocken, Pa.

MECHANICAL RUBBER GOODS BY
REPUBLIC RUBBER DIVISION

proper support for each layer of rope.

Care must be exercised when putting a new rope into service. A few preliminary trips through the working cycle at slow speeds will set the strands more firmly in place, and will also give the operator a chance to see that the drums and sheaves are operating properly and are fitted to the new rope. Maximum service calls for smooth, steady application of power. Sudden acceleration, shock loading or excessive vibration will shorten rope life.

Lubrication is as vital for wire rope as it is for any other machine. For lubricating wire rope in the field a light, penetrating lubricant is required. The lubricant can be brushed on, poured on, or applied in a bath when conditions permit. For proper lubrication, the wire rope should first be cleaned thoroughly and the lubricant must have ample time to soak in.

Regular and frequent inspection will lengthen the life of wire rope. Drums and sheaves should be inspected frequently, since scored drums and battered lagging will impair rope service, and worn filler and riser strips will cause kinking and improper cross-over. Broken or scored sheaves will damage the outer wires of the rope, while worn sheave guards may allow a rope to jump and cause an expensive and possibly serious accident. Also check on the rope itself, as certain sections may get more wear than others. Because of these wear points, it is advisable to shift the rope at frequent intervals to distribute wear.

It is vitally important to know when to replace wire rope. The estimate should be based on the number of broken wires in the rope lay, and the condition of the remaining wires. One way to arrive at a safe practice is to set an arbitrary maximum number of broken wires, and then remove the rope from service for an ultimate strength test. The arbitrary figure can then be revised and rechecked until a practical working guide is arrived at. *Data from Wire Rope Div. of Jones & Laughlin Steel Corp. in Hajoca Industrial Commentator, Jan. 1950, a publication of Hajoca Corp., Philadelphia 4, Pa.*

Road Constructed During Cold Weather

RECENTLY THE city of Midland, Michigan, widened one of its streets. Started on the first of September, the job was completed with the exception of curbing on November 18. Five days later, thanks to calcium chloride set acceleration, the road was open to traffic. In the job, the contractor used 35,251 yards of a 1-2-4 mix. Several tons of calcium chloride were used.

Contractors will make good use of calcium chloride for similar late fall, or for winter or spring construction. In freezing weather, its use will shorten the time that heat must be provided to protect concrete. Many jobs are now completed during the winter that years ago would have been abandoned until spring.

Now new pavements can be opened to traffic in a week, and in many cases where small patching jobs have to be done on busy streets, the street can be opened in 24 hours. *From Dowflakes, Jan. 1950, a publication of Dow Chemical Co.*

Problem: How to protect tanks at atmospheric pressure from fires

THE

BS&B

Combination Vent Valve—

FLAME ARRESTOR Isolates Inflammable Materials from Fire

Note the tanks in the lower left of the above fire scene photograph. These tanks and valued contents were saved because they were equipped with BS&B Vent Valve FLAME ARRESTORS. The device acts instantly to eliminate tank fires.

The BS&B Vent Valve FLAME ARRESTOR may enable you to receive a reduced insurance rate. It will pay you to investigate.

Black, Sivalls & Bryson, Inc.

Special Products Division

Kansas City Tulsa Oklahoma City

FREE CATALOG FOR YOU

This new BS&B Catalog for the Chemical Industry will give you the complete story on Vent Valve-Flame Arrestors and acquaint you with many other BS&B products designed to give you extra protection for your property and to safeguard the lives of your personnel.

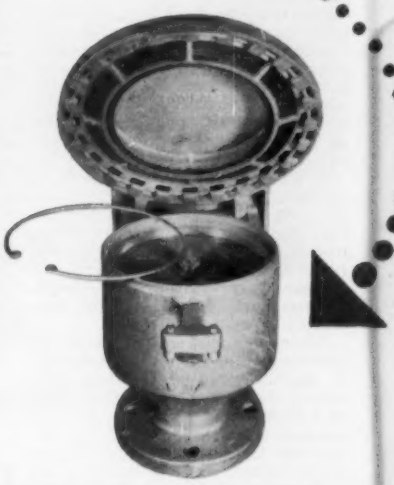
Solution: COMBINATION VENT VALVE

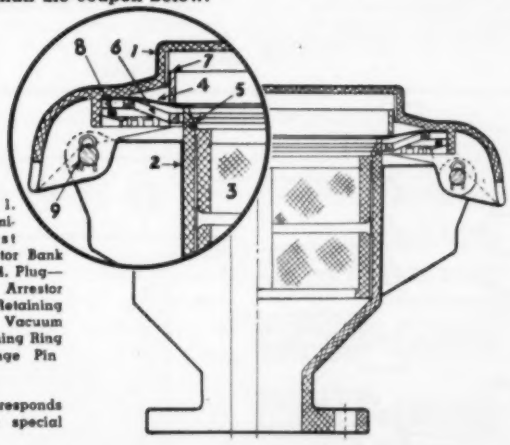
BS&B flame arrestor

The BS&B FLAME ARRESTOR is a neat, compact unit which becomes an integral part of the BS&B VVFA Vent Valve. It adds the advantage of fire control. The Arrestor bank prevents propagation of flame into your tank. Valve is designed to function under internal pressure or vacuum. Any volatile material held in tank storage without proper protection is a potential bomb.

Flame cannot penetrate the honey-combed construction of the all aluminum BS&B FLAME ARRESTOR bank. The BS&B Vent Valve FLAME ARRESTOR operates automatically and requires no hand snuffing or manual attention. It is quickly removed . . . for cleaning or replacement.

Chemical plant executives, engineers and superintendents are especially invited to investigate the new BS&B Vent Valve FLAME ARRESTORS. We will be glad to show the proven protection these units give. There is no cost or obligation . . . just mail the coupon below.





SPECIFICATIONS: 1. Cover—Cast Aluminum. 2. Body—Cast Iron. 3. Flame Arrestor Bank—Rolled Aluminum. 4. Plug—Synthetic Rubber. 5. Arrestor Spring—Steel. 6. Retaining Ring—Aluminum. 7. Vacuum Ring—Steel. 8. Retaining Ring Spring—Steel. 9. Hinge Pin—Stainless Steel.

NOTE: Bolt circle corresponds to 150 ASA unless special drilling specified.

Pressure-Vacuum Vent Valve Flame Arrestor 2, 3, 4, and 6 inch sizes; internal opening pressure (ounces) minimum 0.5, maximum 1.75, and vacuum opening (ounces), 0.5. **Pressure-Vacuum VVH Vent Valve** (Does not include Arrestor bank) Used as secondary relief valve or, as primary relief valve where Arrestor bank is not required.

Valve Inch Size	Opening Pressure Ounces		Vacuum Opening Ounces
	Minimum	Maximum	
2	3.2	16	0.5
3	3.2	16	0.5
4	2.5	16	0.5
6	2.5	16	0.5
8	2.0	16	0.5
10	2.0	16	0.5
12	2.0	10	0.5
16	2.0	8	0.5
20	2.0	6	0.5
24	1.5	4	0.5

NOTE: Pressures in this table are for cast aluminum cover, and they will differ from other metals. Pressure ratings require a manufacturing tolerance of plus or minus 5 per cent. Vacuum opening can be increased.

FREE ANALYSIS WITHOUT OBLIGATION

Jim Myers, Sales Manager will have a BS&B engineer analyze your volatile material tanks and submit suggestions to you WITHOUT COST OR OBLIGATION. Mail coupon or call GRand 6700, Kansas City, Mo. Do it now!

Black, Sivalls & Bryson, Inc., 720 Delaware
Section 2-915, Kansas City, Mo.

☐ Please send me new SAFETY HEAD catalog when ready.

☐ **Please have a BS&B SAFETY HEAD engineer analyze my relief problem, without cost, or obligation to me.**

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City_____ Zone____ State_____

BS&B
FLAME ARRESTOR

Maintenance and Operation

Solvents in "Low Places" Require Extra Care

Contributed by Safety Research Inst.

BECAUSE THEY ARE heavier than air, solvent vapors have a tendency to collect at floor level, in the bottom of tanks, pits, and other low places. To avoid exposure to excessive concentrations of vapor in such places, special precautions must be taken. Otherwise, serious illness may result, as illustrated by the following incidents.

In preparation for laying new linoleum in the corridors of a factory, two men worked on their hands and knees, using a solvent to remove grease and dirt from the floors. After working in this fashion for about an hour and a half, they both became ill and had to be hospitalized for two days.

While on a construction job, a worker decided to clean his car in the field garage. He parked the car over the lubrication pit, went down into the pit with a spray gun and removed grease on the underside of the car by spraying it with solvent. He was found dead in the pit, suffocated by the solvent vapor.

When such jobs must be done, the following rules should be observed:

1. Anyone assigned to work with solvent in an enclosed space, such as a tank or pit, or a tank that has contained solvent, should be instructed to wear a supplied-air or self-contained oxygen respirator. In addition, a life-line should be tied around his waist with the other end in the hands of a watcher who stands outside the work area. The man should be instructed never to remove the respirator while working. In case of fatigue, he should leave the work area and go into fresh air where the respirator can be removed in safety.

2. When floors, room corners, the underside of equipment, etc., are cleaned with solvent, as much ventilation as possible should be obtained by opening all windows, doors, etc. Fans that blow the solvent vapors away from the worker's breathing zone may be employed. If it is impossible to obtain ventilation in these ways, a respirator should be provided.

3. Workers who use solvent for occasional brief cleaning jobs, especially on floors or low parts of equipment, should be instructed not to bend over the work and to avoid inhaling the solvent vapors as much as possible.

4. Early symptoms of vapor poisoning include nausea, dizziness, headache and fatigue. If they occur, the man should cease work immediately and go out into fresh air.

Waste Heat Recovery Leads to Large Savings

Contributed by Compressed Air and Gas Inst.

THE RECOVERY OF waste-heat from air compressors and their driving engines at the plant of Schramm, Inc., West Chester, Pa., is resulting in definite savings. The recovered heat supplies Btu's for which coal, oil or gas would have to be burned with any standard heating system.

In the Schramm plant, three 315 cfm compressors, two driven by diesels and the third by a spark-ignition engine using manufactured gas fuel, deliver about 400,000 Btu's per hour into a system suitable for space or process heating.

In a report recently published by J. L. Michener, Plant Engineer, a system for recovering lost heat is explained. The solution lies in making arrangements for heat recovery, so that cost of heat-recovery equipment doesn't consume the fuel savings that result.

In the Schramm plant, the engine compressors are teamed up with unit heaters. The engines are equipped with marine-type water-cooled manifolds. Water coming off the engine jackets thus picks up Btu's that would otherwise be exhausted to the atmosphere and wasted. Water is taken directly from discharge of the engine-compressor cooling system and circulated by the engine pump through the heating equipment.

Certain controls are necessary. There should be a control in the hook-up to keep unit-heater fans from operating until water reaches a pre-set minimum temperature. This prevents blowing cold air.

For heat dissipation in the summer months, the water can be circulated just as before, but the unit heater fans are reversed to discharge outside the building.

In a case such as this one, the cost of equipment and piping necessary to recover heat and put it to work is relatively small and the scheme results in real dollar savings. The heat recovered is 1250 Btu's per hour per cubic foot per minute of compressor capacity at 100 psi.

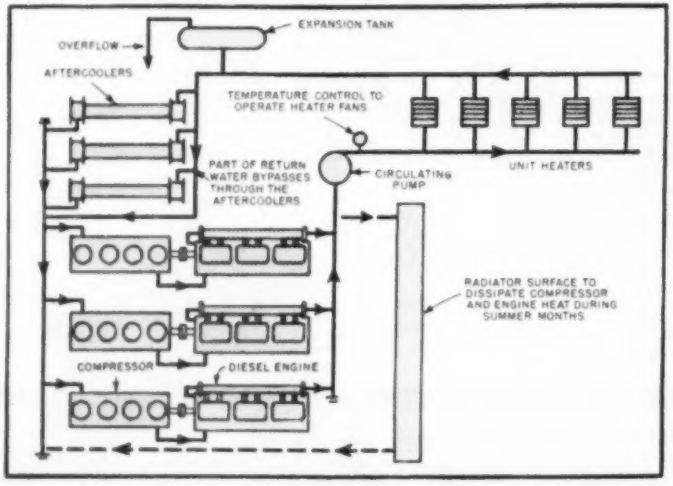
Steel Is Pickled by Magic

Contributed by General Electric Co.

THE WEIRTON Steel Co. of Weirton, W. V. has recently installed a new steel pickling control system process. The system, incorporating a new "magnetic loop control," is used in steel production to govern depth of strip steel as it passes through four successive baths of hot sulphuric acid in the pickling process.

Continuous strips of steel, driven by rollers, are immersed in four

(Continued on page 40)



Heat-recovery hookup shows the water flow through aftercoolers, compressor jackets, engine jackets and manifolds, to pick up Btu for circulation to heaters

Good Outdoor Lighting could have Prevented this

How is the outdoor lighting around your plant? Was it carefully planned as a system or did it "just grow"? If the latter is the case, then a survey will probably show that it is both inadequate and antiquated.

Often such a system can be converted to a modern accident-reducing money-saving system with relatively slight alterations.

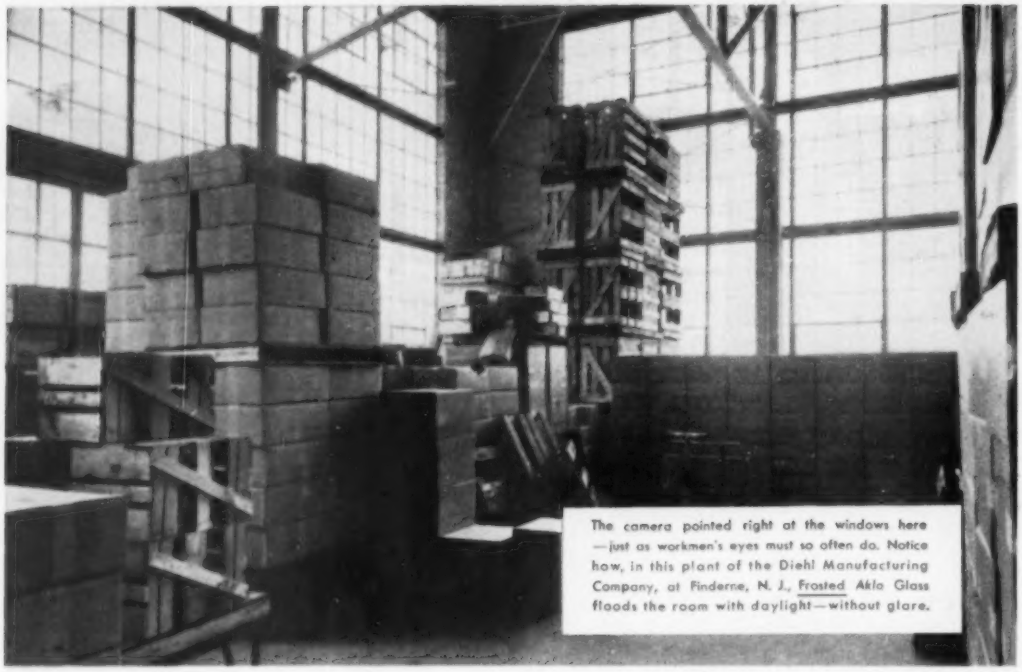
Good outdoor lighting is not difficult to plan, nor is it expensive. Modern fixtures will give you more light per watt, are easily installed, and modest in cost. The experience of a trained lighting Specialist is available to help you with your planning. He will survey your needs and show you how a planned system will speed materials handling, reduce accidents, protect your property and increase efficiency.

See your nearest G-E Apparatus Department office. Send for a copy of "Outdoor Lighting for Industrial Plants." Ask for GEA-3640B.

Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

451-145



The camera pointed right at the windows here—just as workmen's eyes must so often do. Notice how, in this plant of the Diehl Manufacturing Company, at Finderne, N. J., Frosted Aklo Glass floods the room with daylight—without glare.

How FILTERED DAYLIGHT improves working conditions

Windows can do more for you than just bring in daylight. They can *filter* that daylight to give you the most desirable portions of the sun's visible rays. Plants all over the country are using Blue Ridge Frosted *Aklo** Glass for:

1. Better Seeing—This blue-green glass transmits that portion of the spectrum most restful to the eyes. Frosted *Aklo* Glass provides more uniformly diffused daylight, with subdued brightness. This means less eye fatigue, happier personnel, improved quality of work and reduced danger of accidents.

2. Greater Comfort—*Aklo* Glass absorbs a high majority of the heat-loaded infrared rays of the sun and reradiates much of this heat externally. Thus, interiors are cooler, workers are more comfortable.

3. Better Temperature Control—*Aklo's* reduction of sun heat permits more accurate control of indoor temperatures and humidities. It effectively reduces load on air-conditioning equipment.

Aklo is made by the Blue Ridge Glass Corporation of Kingsport, Tennessee, and sold by Libbey·Owens·Ford glass distributors. To see for yourself how Frosted *Aklo* Glass reduces glare and sun heat, ask your distributor for a Radiometer demonstration.

Free Book on Reduction of Sun Glare and Heat

Write to Blue Ridge Sales Division, Libbey·Owens·Ford Glass Company, 9355 Nicholas Building, Toledo 3, Ohio.

BLUE RIDGE AKLO GLASS

Heat Absorbing • Glare Reducing • Figured and Wire Glass

Bulletins on Current Plant Problems

HEATING, PIPING, TRAPS, SAFETY HEADS, ACCESSORIES

101 Safety Head Price List—This is a 16 pp illustrated bulletin explaining sizes, specifications and prices of company's safety heads and accessories, including safety head rupture discs, flanges and vacuum supports, refrigerant relief valves, pressure-vacuum vent valves, and combined vent valve-flame arrestor units. Also gives examples on how to order various sizes of safety heads and accessories. Black, Sivalls & Bryson, Inc.

102 Heating Specialties—Catalog 149 is an ordering book covering traps, regulators, pumps, controls, and similar equipment for hot water, steam and warm air heating. Illustrated by photos and sketches, it includes specifications, dimensional data and application information. Hoffman Specialty Co.

103 Steam Trap—A steam trap for wide industrial and chemical applications using medium and high pressure steam for drying and processing is described in Bulletin 115. Explains and illustrates trap's construction, economy of installation and maintenance, giving discharge capacities, sizes, prices. Stickle Steam Specialties Co.

104 Steam Traps—Catalog 448, 32 pp, provides dimensional, application and engineering data on company's line of steam traps. Includes prices and weights and ordering information and is generously illustrated. Covers industrial steam traps, expansion steam traps, weight-operated and piston-operated types, continuous flow gasoline trap, separators and related equipment. W. H. Nicholson & Co.

105 Converter Data—Twelve-pp Bulletin 70 Section K is recommended to plant engineers because of the complete data included on company's U-tube type converters (hot water heaters). Some 48 standard sizes are described with full dimensions and capacity ratings. Capacities are expressed for various steam pressures from 0 to 25 psi gage, and for nine temperature ranges covering high and low level ranges, the latter usual in radiant heat applications. Also includes pressure drop for each unit at rated capacity and data for determining pressure loss through each unit when operating at less than rated capacity. Installation diagrams, material specifications, data for determining steam requirements and pipe sizes are also provided. Davis Engineering Corp.

106 Rubber Lined Pipe—This illustrated bulletin describes rubber lined pipe for use in industries where there are conditions of corrosion, contamination, abrasion, or flow restricting deposits. Explains eight advantages offered by this pipe, tells where it can and cannot be used. Also covers rubber lined valves and flanges and fittings, as well as flexible rubber pipe. Manhattan Rubber Div., Raybestos-Manhattan, Inc.

107 Glass Pipe and Fittings—Catalog 94 is devoted to glass pipe, fittings and couplings for laboratory and pilot plant use and special services. It's illustrated with photos and dimensional sketches and lists sizes. Fischer & Porter Co.

108 Blowdown Systems—This folder and chart were prepared to show plant engineers the proper size continuous blowdown system for an installation. The chart takes into consideration such variables as impurities in feed water, desired concentration in the boiler, amount and temperature of makeup and boiler pressure. Size of required blowdown system is read directly from the chart. It shows annual fuel savings effected by blowdown heat exchangers based on average fuel cost and boiler efficiency. Corrections to specific costs can be made. Comments on advantages and disadvantages of various types of installations are made. The Henszey Co.

109 Pipe Joint Compound—This is a small folder on a pipe joint compound intended to expand as it sets. Tells how the compound is used and where, and discusses its economy, efficiency and other advantages. Gives specifications. Lists industrial users of the compound and describes briefly some of company's other products. X-Pando Corp.

POWER AND ELECTRICAL

110 Engines, Power Units—Form A-490-MM describes and illustrates carburetor-type power units up to 55 hp designed to burn gas, gasoline or distillate. Tells some of the applications of these power units and a large cutaway drawing, accompanied by detailed description, shows all working parts. Five models are described separately and illustrated by photos. Specifications, dimensions are included, useful attachments listed. International Harvester Co.

111 Battery Manual—Publication GB-748A is the revised second edition of company's 40-pp pocket-size manual of technical instructions and engineering data on the care of motive-power storage batteries. This edition contains a new 4-pp section on the theory of the lead-acid battery. Includes line drawing indicating what goes on when a battery charges and discharges and basic information on specific gravity changes, charging and discharging cycles, positive and negative plate composition, and other battery operation principles. Other sections in book cover care and operation; maintenance and repairs; parts, and technical data. Gould Storage Battery Corp.

112 Oil Circuit Breakers—Moderate capacity oil circuit breakers of quick-clearing, non-oil-throwing design for outdoor distribution service where reliable and safe operation is required without frequent adjustment or inspection are described in Bulletin 71B6093C. Brief text covers construction and features of the circuit breakers and is accompanied by photos of parts. Includes ratings, general dimensions. Allis-Chalmers Mfg. Co.

113 Low-Speed Synchronous Motors—Publication GEA-5332, illustrates typical installations of efficient high-power factor, constant-speed drives, describes their construction features, and indicates mechanical modifications and performance data. Covers three-phase and two-phase motors in company's "800" series with frame sizes of 6184 and larger and ratings from 30 to 13,000 hp. Photos show detail of stator and rotor design. General Electric Co.

114 Selector Switch Data—Here is an engineering data folder complete with target sheet to aid plant engineers in understanding and applying company's push-pull-selector switch. Features detailed illustrations, descriptions and typical applications. Explains in detail how switch provides a single master control that will serve eight to 16 operations by pulling the handle to start, pushing to stop. The target sheet is intended to assist in plotting electrical control requirements. The Arrow-Hart & Hegeman Electric Co.

115 Distribution Transformer—Manufacturer's ACP distribution transformer, self-protected to reduce outages and operating expenses, is described in Bulletin 61B7309A. Mechanical data and the five type designations of the transformer are given, along with a typical load-time curve for one of the units. The transformers are available in ratings of 3 kva through 100 kva—2400 to 14,000 v. Illustrated with photos, sketches. Allis-Chalmers Mfg. Co.

116 Motor Control—A handy reference book on modern motor controls, this is the newest edition of manufacturer's ordering catalog and comprises 76 pp of condensed information, dimensions and prices of the most popular items in company's line. Covers a-c manual and magnetic across-the-line switches; a-c voltage starters, control relays and contactors; synchronous and high voltage starters; d-c control relays, contactors, starters; drum switches, a-c d-c rheostats, speed regulators; push buttons, limit switches, and accessories. Allen-Bradley Co.

117 Splicing Kits—Bulletin J50 presents company's packaged splicing kits for cable joints, both single and double connector types. Describes and illustrates jointing materials provided, tabulates uses of jointing materials and includes instructions for ordering kits. Also provides ordering data on outdoor and indoor terminating kits and telephone cable joints. G & W Electric Specialty Co.

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118 Improved Voltage Regulation — The unit-type construction, low maintenance quick-breaking tap changing, automatic control and other advantages of company's new transformer-type ⅝ per cent step feeder voltage regulators are illustrated and discussed in detail in Bulletin 01B6036C. Generously illustrated with photos and drawings, it provides full operational and engineering data on the regulators. Allis-Chalmers Mfg. Co.

119 Oil Fuse Cutouts—Bulletin CA50, 12 pp, describes company's line of oil fuse cutouts and discusses their advantages. Also covers outdoor and indoor oil fuse cutout boxes, and gives complete mechanical and electrical specifications for both individual and gang-operated cutouts. Includes full ordering data, prices. G & W Electric Specialty Co.

MATERIALS HANDLING

120 Lightweight Hand Hoists—Folder DH-164 introduces company's new line of hand hoists available in capacities from ½ to 4 t. Provides complete specifications, action photographs, a cross sectional view of the hoist, graphic illustrations of the hoist and listing of features. Wright Hoist Div., American Chain & Cable Co., Inc.

121 Lifting Equipment—Bulletin 443 describes and illustrates hand-operated platform lifting devices in both light and heavy duty types, with capacities from 500 to 2000 lb. Includes several photos of these portable elevators in use, handling dies, shop fixtures, barrels, vats. Economy Engineering Co.

122 Portable Hoists—This bulletin describes and illustrates a lightweight air hoist in 2000, 1000, 500 and 300-lb capacities. Gives specifications, dimensions and operating advantages, and contains many pictures of the hoist in use. Also illustrates and provides information on air hoist accessories. Keller Tool Co.

123 Power Trucks—Five models of company's turret trucks for horisontal materials handling are pictured and described in this catalog. Presents platform, pallet and cargo trucks as well as tugs and autoloaders. Power unit and automatic drive are explained and illustrated in detail and specifications and dimensions for trucks are given. Photos show trucks at work. Hyster Co.

124 Industrial Elevators — Bulletin 4851 is a 36-pp revised edition of company's presentation of elevators and cranes and includes the recently developed "Hundred" line of low priced portable elevators in standard models of 500, 1000 and 2000 lb capacities. Also presents hand-operated and electric operated portable types, telescopic portable types, barrel and drum elevators, pallet elevators and many other specialized types. Portable cranes are also shown. Characteristics of the elevators are illustrated in detail, including their safety features. Barrett-Cravens Co.

125 Caster and Wheel Manual—A 192-pp handbook, Catalog 38, covering casters, wheels, glides, desk shoes and accessories, is profusely illustrated with photos and sketches, and provides full ordering data, load limits, sizes and current prices on the line. Also contains much helpful data on the selection of casters according to their application. Darnell Corp., Ltd.

126 Cranes for Power Plants—This unusually pictorial bulletin, Sec. 300, Unit 73 is on cranes built by manufacturer for service in the utilities industries. Illustrates the variety of cranes used in the power field and includes a list of over 350 powerhouse crane installations. Whiting Corp.

127 Coal Handling Equipment—Modern equipment for the storage and handling of coal and ash is presented in 24-pp Bulletin 300. Illustrated with sketches and photos of actual installations, it covers concrete and tile silos, cylindrical steel tanks, and suspended steel bunkers with gravity discharge bucket elevators with pivoted bucket carriers. Also describes and illustrates a skip hoist and other auxiliary equipment. Gifford-Wood Co.

INSTRUMENTS AND CONTROLS

128 Laboratory Thermometers — Chemical thermometers, low temperature thermometers, laboratory thermometer sets, calorimeter and differential thermometers and special test thermometers for various applications are pictured and described in Bulletin C, 24 pp. Gives specifications, ranges and sizes and explains use of instruments. Also includes nomograph for emergent stem correction and conversion tables. Precision Thermometer & Instrument Co.

129 Instrument and Control Panels—Bulletin 773, explains how company's panels are made and where they are used. All operations of fabrication are discussed and illustrated—layout, cutting, drilling, welding, fitting, painting, wiring. Particular features like electric clocks, pressure gages, transformers, name plates, push-button stations and signal lights are discussed. Also includes many photos of panel installations covering all sizes, shapes and designs. The Hays Corp.

130 Laboratory Microscopes — Catalog D-185, 24 pp, describes and illustrates many types of laboratory microscopes, discussing features and construction of the entire line. Provides photos and specifications for several models, including both monocular and binocular types, as well as accessory equipment. Lists prices and quotes terms of sale, ordering procedure. Bausch & Lomb Optical Co.

131 Inside Micrometers — Bulletin R-3 presents inside micrometers for measuring snap ring and O-ring grooves and large, deep, and small bores. Tells advantages of these instruments in terms of ease of use, precision measurement, reduced expenditures for other tools. Gives dimensions in inches. Contains photos of a standard set and several special micrometers. Rimat Machine Tool Co.

132 Plant Wide Flow Measurement — Catalog 83, 12 pp, describes and illustrates meters for permitting plant-wide flow measurement standardization at low cost. Explains use of three basic units in standard pipe tees with indicating, controlling, recording or telemetering instruments. Includes specifications, dimensions and capacity data. Fischer & Porter Co.

TURBINES, PUMPS, COMPRESSORS

133 Mechanical Drive Turbine—Bulletin 4215 contains a complete description and specifications of a single stage mechanical drive turbine for pressures to 1450 psig, initial temperatures to 950 FTT and back pressures to 300 psig, a turbine described as the first of its type to be designed especially for high pressure service. Cutaway illustrations show construction of turbine, labyrinth seals. The DeLaval Steam Turbine Co.

134 Rotary Pumps—The design and construction features, operation and maintenance of company's rotary pumps in 5 to 1500 gpm capacities are explained and illustrated in detail in Bulletin 307. Also covers applications of the pumps and includes photos of various types and several installations. Blackmer Pump Co.

135 Self-Priming Jet Pumps — The advantages and applications for company's cycling jet pumps designed for handling any liquid and for operation by air, gas, or steam pressure, are presented in Bulletin 5030. Discusses pumps' design, simple operation, safety factors, and performance, and includes specifications. Unit is illustrated by blueprint drawing and photo, and two installations are pictured. Fenberthy Injector Co.

136 Electric-Driven Compressors—Form 3150, 20 pp, introduces company's L design compressor, described as a heavy-duty, crosshead type, 100-psi, two-stage design in sizes from 125 to 350 hp. Fully illustrated in color with photos, cutaway drawings, the bulletin explains compressor's operating economy and compact design, showing how its packaged construction and simplified controls afford easy installation and operation. Construction and design features are described in detail with special emphasis on bearings, lubricating system, valves, intercooler and motor drive. Includes ratings, dimensional data, several photos of installations. Ingersoll-Rand Co.

MAINTENANCE EQUIPMENT AND CONTROL SYSTEMS

137 Maintenance Trestles—This catalog covers trestles adaptable to maintenance work, painting and decorating and other off-the-ground work. Fully illustrated with photos of trestles in use and sketches of various units, it gives complete specifications of possible height and length variations, plus full details on a wide variety of accessories. Bil-Jax, Inc.

138 Industrial Floor Sweepers — Easily pushed mechanical floor sweepers are the subject of this illustrated folder. Stresses their cleaning efficiency and economy of operation as well as their safety advantages. Gives specifications, prices; includes list of users. Handling Devices Co., Inc.

139 Preventive Maintenance Controls—Bulletin KD-449 explains how a simplified visible card system for maintenance con-

(Continued on page 91)

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New! TOTALLY-ENCLOSED NON-VENTILATED CROCKER-WHEELER MOTOR

...in ratings up to 3 hp

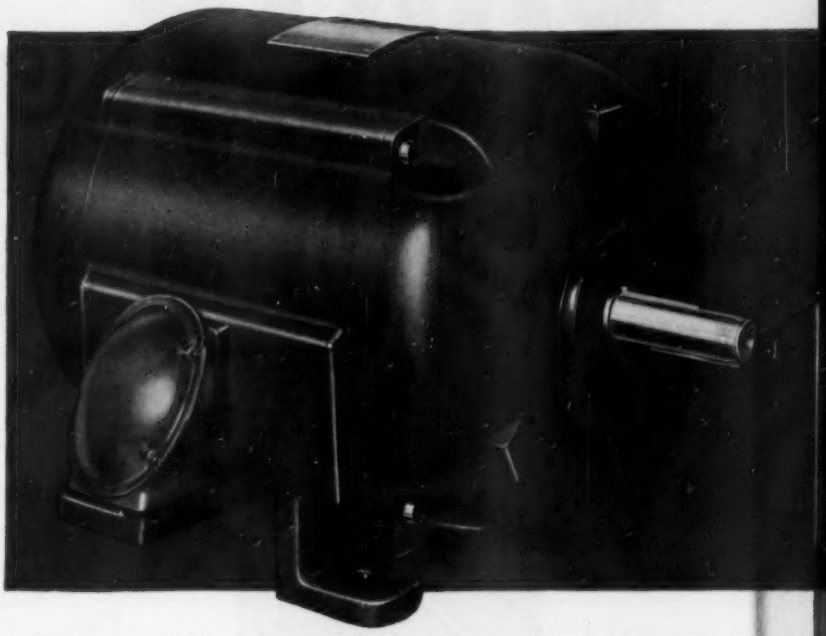
These dollar-saving features make it another C-W "maintenance miser"

NO LUBRICATION NEEDED It's a motor you can install and forget. Pre-lubricated, sealed bearings need no attention for at least five years.

COMPLETE PROTECTION against conducting or abrasive dust, acid or alkali fumes, corrosive liquids, air-borne moisture, steam, corrosive gases, metal chips, lint.

BEATS RUST AND CORROSION Frame is rugged gray iron, for highest resistance to moisture and corrosion. There is no steel to rust.

FOR ANY APPLICATION (up to 3 hp) where excessive maintenance is indicated.



Now — a complete range of Totally-Enclosed C-W Motors for every industrial need!

This new line of C-W Totally-Enclosed, Non-Ventilated Motors is designed for the same type of applications as the Sealedpower Motor. Available in sizes up to 3 hp in NEMA frames 203-225, they are particularly suitable for hoist duty.

You can install a Crocker-Wheeler Form BE motor in inaccessible places — and forget it! Its double-row-width sealed bearings are pre-lubricated. Vital operating parts, sealed in a frame of sturdy gray iron, are completely protected, just as in the maintenance-saving Sealedpower Motor.

Now you can get the engineered economy of Crocker-Wheeler's totally-enclosed motor design no matter what NEMA rating you require. Mail coupon for bulletins covering the complete range.

In ratings from 3 to 100 hp

C-W SEALEDPOWER

Totally-Enclosed...Fan-Cooled Motor Saves 80% of Maintenance Costs!

No other motor in its class has exterior cooling, with the fan-driven airstream (blowing over the finned frame) carrying dust and fumes *outside* and *away*. Fins provide 150% more cooling surface! Mail coupon for full details.

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Ampere, N. J.

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Why? Because Darts are designed to be used over and over again. First of all, they have two bronze seats spherically ground to form a true ball joint. Thus, they tighten easily — form a drop-tight connection without excessive wrenching. No need to stretch or jam the seats. And once in place, the practically indestructible, air-refined, malleable iron of body and nut shrugs off tough abuse. Uncouple them whenever you want — use them over and over again.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART
UNIONS

(Continued from page 34)

tile-lined tanks of boiling acid. The new control regulates tension of steel strip as it moves through the tanks, preventing the metal from scraping the bottom of the tanks, thus damaging the surface finish.

The new control is activated by an electric coil imbedded in the bottom of the second of the four tanks. A magnetic field, set up within the sulphuric acid by the coil, is influenced by the steel strip as it passes through the tank. If the strip moves through the bath at the wrong depth, the amount of current flowing through the coil is changed. This change is detected by a magnetic amplifier, or "amplistat," connected to the immersed coil.

The amplistat automatically "compares" this current to a standard current, equal to the current passing through the coil when the steel is at proper depth. The difference between the two currents is amplified, then used to regulate the motor driving the roller, which feeds the steel strip into the tanks.

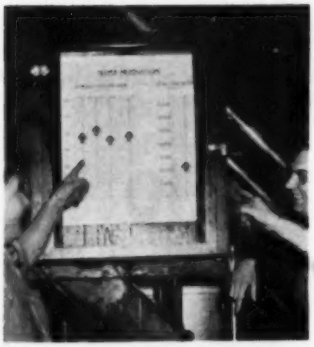
If the steel passes too close to the coil in the bottom of the tank, the roller driving the strip through the tanks is automatically slowed down, thus regulating immersion depth of the steel.

Production Chart Ups Crews' Interest

KEEN RIVALRY in tonnage of pipe tested has resulted from recent installation of this glass-framed, illuminated production chart in the threading division of The National Supply Company's Spang-Chalfant Division plant at Ambridge, Pennsylvania.

Operating management reported that the new "scoreboard," which was designed and built by plant employees, has stimulated competition among men of the different crews or work turns. They watch the tonnage ups-and-downs of each crew or turn as if they were Irish Sweepstakes results.

The tonnage figures show cumu-



The first four columns of the production chart show the workers how each crew is doing; last one gives totals

In the Modern NUTONE Plant

...6 DIFFERENT INSTALLATIONS By KIRK AND BLUM!

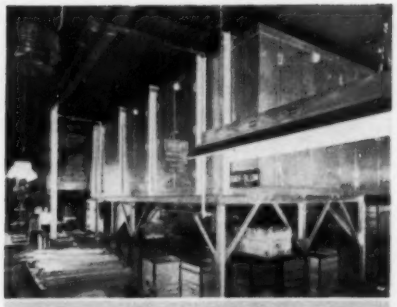
Paint spray booths in the Nu-Tone Incorporated plant.

- 2 DUST CONTROL SYSTEMS
- DEGREASING AND ACID ETCHING VENTILATION
- PAINT SPRAY BOOTHS (INSTALLED ONLY)
- PAINT DRYING OVEN AND CONVEYOR
- MAKE-UP AIR SUPPLY SYSTEM

A variety of problems in the Finishing Departments of NuTone Incorporated, were solved by KIRK & BLUM Engineers. Shown here are the various installations which were designed, fabricated and installed by KIRK & BLUM.

Of special importance is the "Make-up" Air Supply System which filters, heats and replaces air exhausted by the other systems, eliminating undesirable winter drafts.

The wide experience of the KIRK & BLUM organization is at your service. "Clean Air . . . the Invisible Tool" can do much to increase the efficiency of your operations. For more details and literature, write The Kirk & Blum Mfg. Co., 2889 Spring Grove Ave., Cincinnati 25, Ohio.

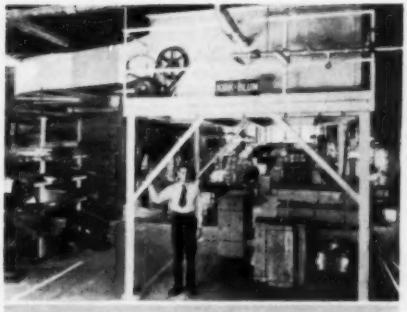


Overhead conveyorized Paint Drying Oven installed complete by KIRK & BLUM.

FOR CLEAN AIR . . . THE INVISIBLE TOOL

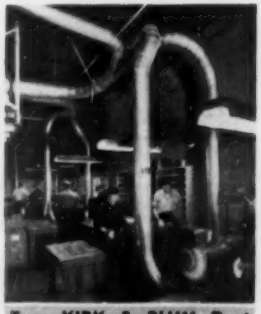
KIRK AND BLUM

DUST AND FUME CONTROL SYSTEMS
INDUSTRIAL OVENS



"Make-up" air supply system replaces air exhausted from plant.

Fume Removal System in the Acid Etching and Degreasing department.



Two KIRK & BLUM Dust Control Systems serve the polishing and buffing room.

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▶plant maintenance
▶product touch-up
▶small parts finishing

with a Binks DP* portable spray painting unit

product touch-up

small parts finishing

The only paint spray unit that gives you 1 H.P. performance at ½ H.P. cost

You pick up the Binks DP portable spray painting unit and take it straight to the job. Right Johnny on the spot, you touch up damaged finishes...do painting that would require moving items back to the finishing department. You can maintain production schedules...keep your assembly line moving smoothly. Always sure of quality finishing, you use the DP unit anywhere there's a paint job to be done.

By actual test, this sturdy ½ horsepower Binks DP portable spray painting unit applies coatings with the same speed and quality as a full horsepower outfit...for only a fraction of the cost. Weight is only 47 lbs. For operation on 110-120 volts, a.c. A gas engine model is also available.

"The Binks DP unit is just one of the many Binks developments designed to make finishing easier and more economical for you."

Chairman of the Board

Send today for your free copy of the illustrated Bulletin No. 601 which describes fully the DP unit and eight spray gun combinations for use with it. Learn how you can use the DP unit for maintenance work, small parts finishing, production touch-up, dusting, and drying.

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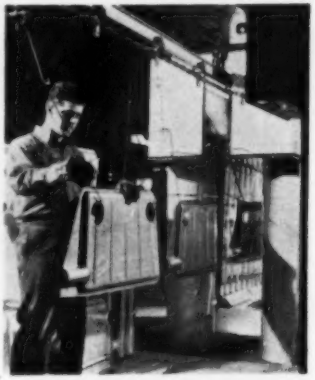
lative hourly averages for each crew and for the combined crews and the total tons tested to date—the same information formerly given on conventional production charts—but foremen say their crews show far more interest than formerly.

Radiant Oven Degreases Metal Parts

Contributed by Edwin L. Wiegand Co.

ALL-METAL electric radiant heaters are being used by Lawson Mfg. Co., Pittsburgh, in place of the vapor method to degrease sheet-metal parts.

Degreasing 31 in. by 20 in. sheet-metal parts is now done at a fraction of the cost of the old method. A continuous conveyor now carries the parts without interruption through a space-saving infrared oven that removes all traces of oil in 36 seconds. The oven consists of two banks of nine vertically mounted 3.6 kw radiant heaters, each bank with a heater at the base mounted on a 45 deg angle to increase the temperature on the bottom edge of the work. Total installed capacity is 72 kw. The heated section of the oven is approximately 3 ft long and the conveyor moves at 5 ft per minute.



Parts are attached to the conveyor for the 36-second trip through the radiant-heated oven which degreases the metal

During the 36 seconds the parts move between the heater banks, the temperature rises and vaporizes the oil coating. An economy factor is the oven's 2-minute heatup time which permits the use of heat only as needed.

Air Conditioning Watches and Clocks

AIR CONDITIONING is proving to be a boon to one of Abilene's newest industries, the United States Time Corp. plant, where watches and clocks are manufactured. The equipment provides close dust and

Shown is a 3-roll Belt Idler. Built to take the brunt of the punishment handed out by large tonnages day after day, Jeffrey Belt Idlers have gained wide recognition in many fields where continuous, uninterrupted service is the demand. Equipped with Timken tapered-roller bearings.

BELT CONVEYORS

This happens to be SUGAR but Jeffrey belt conveyors are versatile — handle all sorts of bulk material — keep it on the move in a way that spells additional profits for you. You'll like the continuous, uninterrupted service that Jeffrey belt conveyors can provide. If it's material handling of any kind you can depend on Jeffrey.

THE JEFFREY MANUFACTURING COMPANY

Established 1877

905 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

JM

Baltimore 2, Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 13, Denver 2, Detroit 13, Harlan, Houston 5, Huntington 10, Jacksonville 2, Milwaukee 2, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 1, Salt Lake City 1, Scranton 3

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No matter how bad! Smoke, heat or both can be cleared out and fast, if the problem is approached in the right way.

A foundry job is shown here only because foundries are as tough as any. Robertson has engineered ventilation—successfully—for every kind of smoke problem, including many a foundry.

Ventilation Engineering approaches the job with an analysis of all conditions, a study of how much air has to be brought in and ends with the decision on what type of ventilator will do the job best and at lowest cost. The Robertson Company can engineer objectively, without carrying the torch for any type of ventilator, because it makes *all* types of ventilators. We don't just sell ventilators. We do *Ventilation Engineering.* It doesn't cost any more to have the job done right. Robertson has been engineering ventilation for forty-four years, all over the world. The many types of ventilators we recommend are shown in our

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Photo shows the usual amount of dust, heat and fumes created during a shake-out in a typical foundry.

Less than a minute after shake-out is completed. Photos are unretouched. Automatic-damper Fan Ventilators made this possible.

There's a Robertson Ventilator for Every Requirement

humidity control—which are important factors contributing to the effectiveness of the watch and clock assembly operation.

All equipment has been installed in a penthouse with dimensions of about 20 by 60 feet, with temperature controls installed on the first floor where both heating and cooling can be regulated from that point. The equipment proper consists of six water-cooled reciprocating compressors with a total refrigerating capacity of 75 tons. Power is supplied by three 25 hp electric motors, each driving two compressors.

To change the automatic system from cooling to heating, or from heating to cooling, a double-throw switch is moved from one position to another. Conditioned air is carried throughout the plant by ducts and is discharged from ceiling air distribution outlets.

Electric Heaters Keep Oil Flowing

Brooks Oil Co., Cleveland, manufacturer of extreme pressure lubricants for heavy industrial machinery, remedied a high-cost manufacturing problem by installing Calrod tubular heaters on storage tank pipe lines.

During manufacturing this heavy compound oil flows through a series of temporary storage tanks. Because of its high resistance to flow a temperature of 375 F must be maintained to keep the oil moving freely through the tanks. Steam heat under

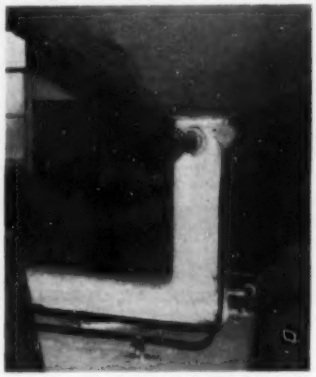
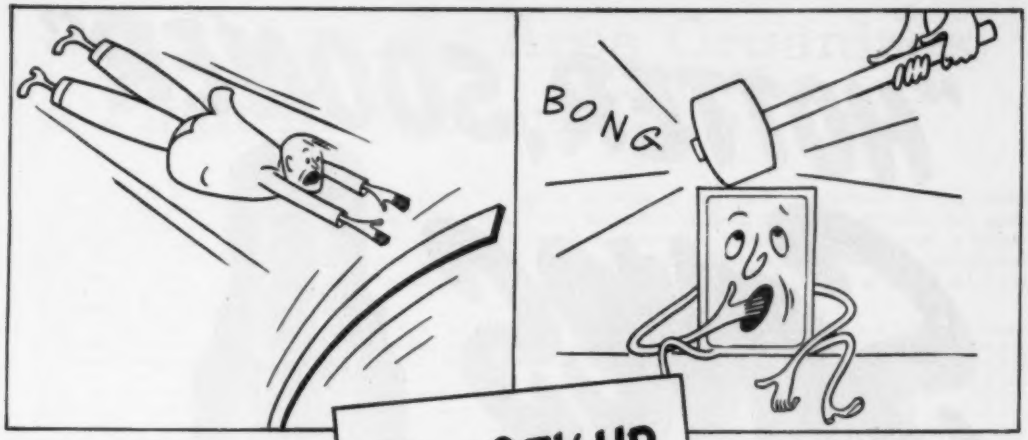


Photo: General Electric Co.

Heating unit in this installation can be seen just to the right of pipe leaving base of oil storage tank at Brooks Oil Co., Cleveland

pressure was formerly used to heat the tanks and pipe lines, but operating costs were high due to high heat loss and uneven heat distribution.

Calrod formed tubular heaters have now been clamped to the base of each tank. These heaters have also been wound around the pipe lines and covered with protective layers of sheet metal and asbestos, cutting heat loss to a minimum.



New 2-7½ HP Manual Starters

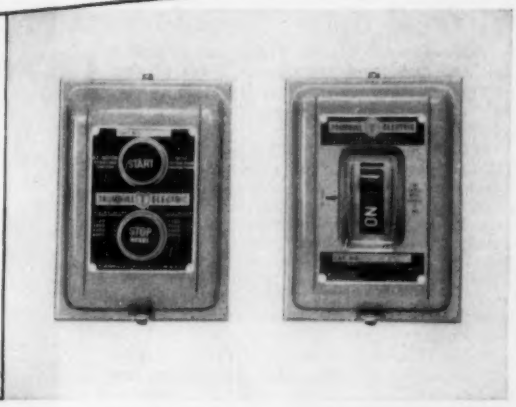
save "crossing your fingers"

Fast-Acting on Overload or Stalled Rotor Conditions

Improved thermal overload device is factory-calibrated to follow normal heating curve of motor. Handles *both* overload and stalled rotor. Trips promptly—the higher the overloads, the faster the response. Choice of 90 heater units in fractional ampere steps.

But It Won't Act When It Shouldn't

Unique latch mechanism minimizes false trip-out. A trigger mechanism gives positive, quick-acting tripping on overload—reacts only to bending of heater strip, not to vibration or knocks. And metal guard protects toggle or push-button from accidental operation.



It's Even Hard for the Operator to Do Wrong

No parts to replace after overload. Contacts cannot be held closed against overload. ON, OFF, RESET positions clearly indicated on toggle type; START and STOP on push-button types. Resetting directions clearly visible on both types. Line and load circuit numbers on barriers between contacts. Covers and toggle can be locked.

PT Means "Push-button or Toggle" ...in All Sizes

All sizes of Trumbull's PT Starter available with push-button or toggle operation in general purpose enclosures. Water-tight or explosion-proof enclosures are also available. Fine silver, butt-type contacts are easily inspected. Write for Bulletin PT. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn.

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

"HOTTER, SOONER" Saves YOU MONEY

Yarway Impulse Steam Trap with new stainless steel body.

Yarway Impulse Steam Traps get equipment hot and into production *faster*. Extra profits!

Then they keep it *continuously* at peak operating temperatures for maximum production. More extra profits!

What's the reason for *hotter, sooner?* Just this. When steam is turned on, Yarways open wide, discharging the air and condensate *in a hurry* —closing only when steam arrives. Then, when operating temperature has been quickly reached, the little valve (only moving part) literally *floats on the load* . . . discharging heat-retarding condensate as soon as it forms instead of waiting for quantities to accumulate. Thus equipment is held at peak operating efficiency.

Other economical features of Yarway traps—minimum maintenance, easy installation, low initial cost.

More than 600,000 Yarways have already been installed. Sold by distributors throughout the world.

Try a Yarway today . . . standardize on Yarways tomorrow.

YARNALL-WARING COMPANY
145 MERMAID AVENUE, PHILA. 18, PA.

Nest of Yarway traps installed with Yarway Strainers on cloth dryer. Note small space required.

Stainless Steel Body

YARWAY IMPULSE STEAM TRAP

San Francisco Area Organizes a Plant Engineers Club

Increasing industrial activity in the west emphasized by the recent formation of a Plant Engineers Club in the San Francisco Bay Area . . . Plant engineers from diversified industries ranging east to Stockton and from Vallejo south to San Jose represented at organizational meeting . . . Charter members look forward to four or five local clubs

ON MARCH 21 a group of leading plant engineers of the San Francisco Bay area met at the Palace Hotel and formed a local Plant Engineers Club. Rollin J. Lobaugh, Pacific Screw Products Co., San Francisco, was selected as temporary chairman and Ed F. Sullivan, San Francisco Naval Shipyard, as secretary.

Charter members represented industrial plants ranging east as far as Stockton, and from Vallejo south to San Jose. By drawing upon the large industrial concentration of the area it is expected that four, or perhaps five local clubs, tied together in a loose association and with periodic joint meetings, may eventually materialize.

In the meantime, the charter members considered it advisable to build slowly and develop as a single club meeting monthly in the different localities. Oakland was chosen for the second meeting on April 20; Stockton was tentatively discussed for a later date. Following the permanent organizational meeting in Oakland a membership drive is planned based primarily upon each member bringing in one prospective new member to each future meeting.

As membership grows it is anticipated that several local clubs will be formed, each operating independently in an area but with provisions for periodic joint meetings with the other clubs. Conforming to the natural geographical division of the area, local clubs in San Francisco proper, on the Lower Peninsula, in the East Bay Cities, in the Richmond-Vallejo-Pittsburg Area, in Stockton and possibly in the South San Francisco Region seem logical possibilities in the near future.

This movement parallels similar activities in the industrial centers of the east and middle west. The Plant Engineers Clubs or Associations in Boston and New York have demonstrated the value of local groups in meeting personal and company needs of plant engineers and filling a gap existing between national engineering societies.

Plant engineers in the San Francisco Bay Region, interested in the Club, are requested to contact any of the charter members listed. Plant engineers in other sections of the country, interested in a similar club, are urged to get in touch with The Editor, PLANT ENGINEERING.

Plant engineers of the San Francisco Bay Area meet to organize a Plant Engineers Club which, it is expected, will eventually develop into four or five branches with periodic joint meetings. Sub-caption, below, identifies the charter members

Names and company connections of the charter members of the San Francisco Plant Engineers Club, in photo, above. Unless otherwise indicated, title is Plant Engineer. Local telephone numbers are included for the convenience of engineers in that area interested in membership. Plant engineers in other sections, who would be interested in a club, should write to the editor of PLANT ENGINEERING.

1. Fred M. Reibin, Enterprise Engine and Fdry. Co., San Francisco. (MI 7-0862)
2. J. A. Heinz, International Harvester Co., Stockton. (ST 4-4811)
3. W. B. Kinyon, The California Ink Co., Inc., Berkeley. (LA 5-1188)
4. R. H. Morris, Editor, PLANT ENGINEERING, Chicago, Ill. (DE 2-5446)
5. Ed F. Sullivan, San Francisco Naval Shipyard, San Francisco. (VA 4-1900, Ext. 2366)
6. F. J. Smith, Western Pacific Corp., Palo Alto. (DA 3-4755)
7. C. B. Olmsted, American Home Foods, Inc., San Jose. (AX 6-4806)
8. G. H. Perkins, Senior Engr., Shell Chemical Corp., Pittsburg. (PI 800)
9. Kermit M. Paulson, Bethlehem Steel Co., (Shipbuilding Div.), San Francisco. (MA 1-3200)
10. Ernest E. Hill, Pacific Electric Mfg. Corp., San Francisco. (AT 2-0810)
11. E. J. Hinde, National Lead Co., Oakland. (AN 1-0180)
12. W. G. Norman, Victor Equipment Co., San Francisco. (GA 1-3000)
13. C. H. Warren, Asst. Shop Supt. (Plant) Mare Island Naval Shipyard, Vallejo (VA 3-4511, Ext. 6180)
14. Rollin J. Lobaugh, Owner, Pacific Screw Products Co., San Francisco. (HE 1-3981)
15. Jack Slatky, S. F. Chamber of Commerce, San Francisco. (EX 2-4511)

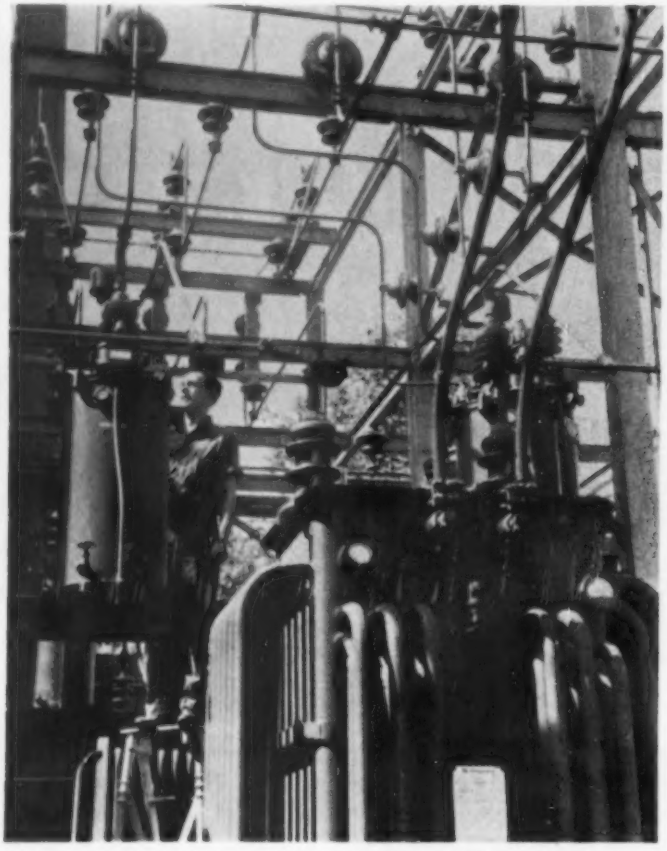
Cut Electrical Breakdowns
Check Up On Care, Operation

Protect and preserve the insulation on electrical machinery and you go a long way toward preserving the equipment for a long period . . . Moisture, accumulated dirt, and oil three of the major foes of electrical equipment . . . Remedies and preventive measures for each . . . Use of instruments to check condition of machinery . . . Care of commutator and bearings . . . Check up on the holding bolts, loose belts . . . Care and maintenance of control and starting equipment

By **IRWIN ROBBINS**, Electrical Engineer, Factory Mutual Engineering Division

THE GREATEST SINGLE cause of electrical machinery breakdown is the failure of insulation. Despite improvements in insulating materials in the past decade, insulation is still the most vulnerable part of an electrical machine. Proper care and protection of the insulation is consequently one of the major problems of the operator.

Predominating causes of insulation failures are moisture, lightning, excessive operating temperatures, shrinkage of the insulation, dirt or other foreign matter on the windings, soaking of windings with lubricating oils, and deterioration due to age.



All important electrical equipment requires periodic inspection and maintenance

It is difficult to prevail upon the average motor or generator operator to keep his equipment clean. The effects of accumulated dirt and other foreign matter on the insulation, if not directly resulting in an insulation failure, will contribute in large measure to decreasing the life expectancy of the windings. Wherever compressed air is available, it is advisable to blow windings clean at regular, periodic intervals, depending on local conditions, at pressures not exceeding 40 psi. Dirt can plug up ventilating passages. This in turn causes excessive operating temperatures.

Moisture should be guarded against. Getting onto the windings, moisture will eventually work its way into the insulation and cause deterioration. Occasionally, moisture is sufficient to cause grounding. In locations where moisture is excessive, splash-proof and moisture-proof equipment should be used.

Many operators of electric motors have a tendency to over-oil their machines. When the oil wells are filled to overflowing, the overflow drip may be drawn onto the windings by the suction created by the motor ventilating blades. Oil on the windings will eventually soak into the insulation and cause it to break down.

When windings have become oily, the best procedure is to dismantle the motor and wash the windings thoroughly with carbon tetrachloride. The windings should then be baked dry. When it is certain that all moisture has been removed, at least one coat of a good grade of air drying insulation varnish should be applied.

Many insulation failures are brought about by shrinkage of the insulation, such as when slot insulation, wedges and fillers shrink and permit movement of the coils in their slots, with the result that chafing of the coil insulation grounds the winding. Insulation

shrinkage on the rotor of slip-ring type motors and on direct current armatures causes loosening of the banding wires which finally results in serious winding failures of both rotating and stationary members. With good care and maintenance this condition can be deferred, so that the maximum life of 25 to 30 years can be obtained from a winding.

Experience has shown that many d-c motor and generator failures are brought about by accumulations of dirt or other foreign material on the rear sections of commutators and behind the risers. The best means of combatting this condition is to construct a nozzle of a piece of ¼ in. copper tubing, bending it so that it can be slipped in behind the risers, and blowing the dirt out with dry compressed air. In some cases where the dirt has lain for a considerable time and cannot be blown out with compressed air, it has been found practical to spray carbon tetrachloride to loosen it, and then blow it out with air. The spraying should be done in a well ventilated area because of the toxic effect of the vapors.

There is no practical or reliable method for determining the internal condition of coil-insulation. The nearest approach is to check insulation resistance to ground periodically with an ohmeter. While insulation resistance is affected by many external factors, such as moisture, cleanliness, temperature of winding etc., resistance readings, when properly made and analyzed, give more information about a winding than any other method that can be simply and readily applied.

In addition to emphasis on care and maintenance of insulation and windings, other points require attention.

On d-c machines, the commutator, if given reasonably good care, will cause little if any trouble. Care should be taken to keep the commutator clean at all times. The surface should be kept smooth and concentric, and the mica should be slightly undercut. Emery paper or cloth should never be used to smooth down a commutator as the emery is a conductor. It is safe, however, to use sand paper. If brushes must be renewed, the manufacturers' recommendations should be followed as to type of brush and the amount of tension to be applied to it.

Bearings of the sleeve type should be kept lubricated with a good grade of oil, and care should be taken that the oil rings turn freely. If bearings are of the ball or roller type the manufacturers' recommendations as to lubricant should be followed.

Loose or frayed belts will cause a pounding which will be transmitted from the pulley to the bearing, causing undue wear. An excessively tight belt will also cause undue wear. A simple way to check on bearing wear is by means of "air gap" measurements; that is, measuring the space between the rotor and stator at four points 90 deg apart with a feeler gauge.

Precautions should always be taken to see that no dirt or foreign matter gets into the bearing wells where it can mix with the oil and damage both the bearing and the shaft.

It is also important to make sure that all holding-down bolts are tight and that the bolts holding the end bells in place are tight. Ceiling mounted machines should have lock nuts on top of the regular holding nuts or cotter pins through the bolts.

In the care and maintenance of control and starting equipment, it is most important to inspect contacts to make sure they are properly adjusted and are making good contact. Pitting or burning of the contacts is usually the result of poor electrical contact and eventually will cause failure not only of the controller, but also of the controlled equipment. When necessary to "dress" copper contact tips use a file. Silver contact tips ordinarily should not be filed; rough spots will do no harm and the silver surface which is thin might be destroyed completely.

On controllers with oil-immersed contacts, see that the oil is kept clean and free of sludge. On the larger units of this type, there should be a vent to relieve pressures built up inside the oil housing by vaporization of the oil by make-and-break arcing.

The handles on manually-operated reduced-voltage type starters should never be blocked or tied in the "run" position. This is bad practice because it does not allow the overload and low-voltage protective devices to be effective in case of emergency.

Over-loading of electrical equipment is another frequent cause of failure. This can be avoided by the use of good over-load protection. The best types for motors are temperature or thermal relays and thermal cutouts. The general practice is to select a relay of approximately 25 per cent greater capacity than the rated nameplate full load

Typical damage to generator windings. Good maintenance prolongs insulation life

(Continued on page 71)

Three Basic Considerations in Plant

THE LOCKLAND PLANT of the General Electric Aircraft Gas Turbine Division was established formally on October 18, 1948 with the occupancy of the present premises. The nine acre building occupied, had been used previously for the testing of war-time reciprocating aircraft engines and the manufacture of some of its components. It had to be converted to accommodate the assembly and testing of the latest jet engines.

In establishing the basic floor layout major consideration was given to the principle of Direct Flow materials handling. With that in mind; and in view of the size and shape of the existing building, principally the relationship of the Receiving and Shipping areas to the Test Cells; it was decided to place the Offices, the Maintenance and the Machine Shops, and all miscellaneous manufacturing in the basement.

This left the main floor available for the principal manufacturing activities and allowed a floor layout which would permit completed engines from the Green and Final lines to be fed directly to the Test Cells. In turn, this arrangement lent itself admirably to a one-directional flow of parts from Receiving to the Assembly areas. All major and most minor parts could be inspected and stocked on lines perpendicular to the initial main assembly line and in the sequence needed. The accompanying flow chart shows how the existing plant was utilized to best advantage in eliminating unnecessary parts travel.

An outline of the parts flow will serve to illustrate the use of the major principle as worked out. All parts are received at either the Truck or Railroad Dock and are taken immediately into the Receiving Department by fork truck. The Receiving Department receives and uncrates the material and moves it again, by fork truck, to the Bonded area. This area serves to hold the material temporarily in bond until cleared for necessary affidavits or laboratory releases.

It serves, also, as a metering agency to maintain a steady flow of parts to inspection, thus avoiding a flood of parts at one time and a dearth at another. Major pieces move from the Bonded area to Cleaning on a roller conveyor, where possible in the base of the original shipping container. The shipping container is thus made to serve as a pallet through Inspection and Stock. This arrangement minimizes trucking in these areas. Those parts requiring cleaning prior to Inspection are degreased.

After cleaning they move by a continuation of the roller conveyor, or in the case of unwieldy parts, on special dollies to their respective Inspection lines. Major parts are inspected progressively as they proceed along these lines. Small parts move directly from the Bonded area to Inspection on another roller conveyor in the original shipping container or in tote pans, and are inspected on adjacent benches. Parts found to be discrepant in either Major or Minor Parts Inspection are moved by truck to the Material Review Board crib where final disposition is made.

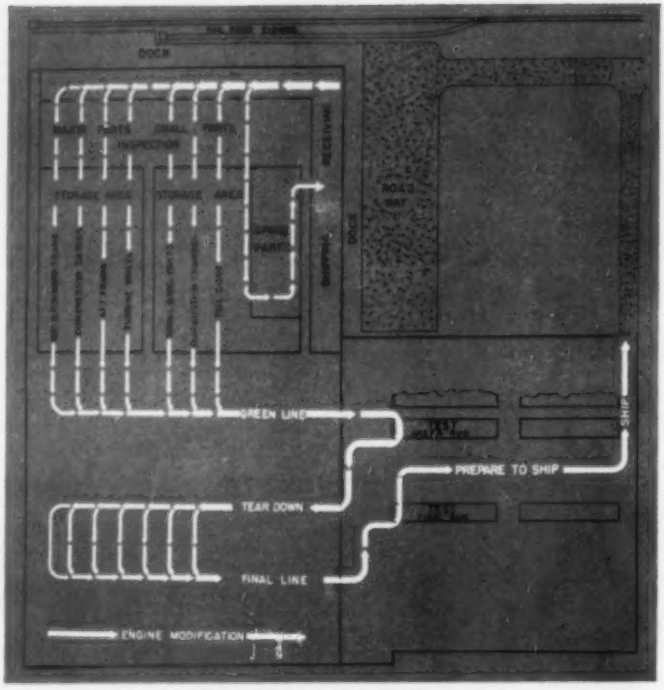


Fig. 1. Flow chart of the Lockland plant shows how material is carried throughout entire assembly operation and through two test runs, by direct flow of supplies

Accepted materials move directly to the Stock Accumulation area, usually by a continuation of the inspection conveyor. They are stored here on pallets in pipe racks, or on standard metal shelves as the case may be. Handling of the major parts in this area is by a monorail crane stacker. The use of this crane stacker permitted stock room aisles to be reduced from an original 9 ft width to 6 ft. The saving of space easily justified the greater expenditure.

Moreover, greater stability and security in handling the costly major pieces is experienced. Fig. 3 shows the use of the pipe racks. These racks are used throughout the Stock Accumulation area for the storage of major parts. They permit great utilization of floor space and can be readily and efficiently changed to accommodate the size of new models.

Large parts are moved from Stock to Initial Subassembly areas on conveyors. Where practical the assembly operations are done on a continuation of these same conveyors. Where not, assembly dollies are used as shown by Fig. 2. Small parts are maintained in economical quantities at work stations spaced along the lines. The subassembly lines are, in the main, perpendicular to the main line and in the order of precedence required. Lifting of the work is by electric hoists on monorail predominantly. A few bridge cranes are used. Sub-assembly and Main Line operations are performed progressively and in predetermined sequence. Completion of the engine assembly occurs at a point immediately adjacent to the Test Cells.

After completion of the Initial Performance test the engine moves to the Inspection and Final

Layout

Major consideration given to principle of direct flow materials handling . . . Offices, maintenance and machine shops, miscellaneous manufacturing located in basement . . . This permitted one-direction flow of parts even through test cells for completed engines . . . Use of original shipping container base as pallet . . . Standard shelving or pipe racks used in stock accumulation area . . . Electric hoists on monorails, bridge cranes, conveyors, special assembly dollies among equipment used

By G. W. WALLACE, Supervisor, Planning, Methods, Aircraft Gas Turbine Div., General Electric Co.

CONSTRAINT — Part must move in predetermined direct flow path at balanced rate, in sequence. Each operator prepositions piece for next man.

SIMPLIFICATION — Operations broken down into simple components and grouped in balanced, progressive work stations. This simplifies supervision, control and worker training.

FLEXIBILITY — Fixed installations kept to minimum and logical direction of expansion provided. Permits rearrangement for future needs at minimum expense.

Assembly line. Here the engine is partially or completely disassembled on a percentage basis in reverse sequence to the initial build up. This permits the parts that are removed to flow across to the final build-up line in sequence for final assembly. These transverse lines, again on roller conveyor or using dollies as the case may be, serve to provide cleaning, inspection, minor rework, sub re-assembly positions needed.

Operations throughout the assembly areas are progressive. Each unit of production moves through a sequence of operations arranged into balanced work stations. The required tools are placed at each station on tool display easels. The instructions or procedures to be followed are similarly displayed. The smaller parts required to attach or complement the major pieces, are provided in hopper bins or parts drawers convenient to the operator. All these constitute a unit package which assures that the work to be done may be performed in the most efficient fashion possible.

The effect of the application of the direct flow principal, coupled with effectively balanced progressive work stations, is to provide a system that operates with a minimum of supervision and controls; assures that the first piece in will be the first used; and minimized training requirements. It permits, too, as small a process inventory as can be obtained except with a paced power conveyor.

One other major consideration kept in mind throughout should be mentioned. The entire aviation industry, due to its rapid succession of Design and Process improvements, is peculiarly subject to change. What is current today is at least obsolescent tomorrow. Because of this fact, every effort was made, as the layout progressed, to keep in mind tomorrow's requirements. This effort was made in two directions; first, in being committed to as few fixed installations, as possible, and

(Continued on page 96)

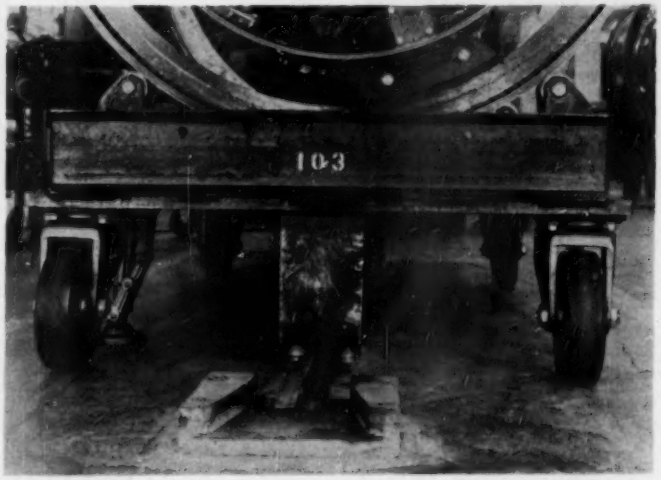


Fig. 2. T-track and dolly used for final assembly in some operations at Lockland

Fig. 3. Stock accumulation area which uses pipe racks or shelves for storage

SHOOTING THE ROOF HELPS TRIM BUILDING COSTS

Applicable to practically all types of roofing, siding and decking installed on steelwork welded studs cut installation costs anywhere from $1.33 to $14.44 per square depending on type of installation and allowance for overhead . . . Special considerations for aluminum roofing

LABOR AND INSTALLATION costs form a substantial portion of the total cost of industrial roofing, siding and steel deck costs. Using conventional methods these may range from a low of about $6.00 per square for tack welded steel decking to a high of about $40.00 a square for formed siding. A square is 100 sq ft, a unit universally used in the roofing industry.

High labor costs of recent years have spurred the development of cost cutting construction methods. One of these developments widely used for roofing, siding and other varied applications is stud welding. By this method studs of various shapes are welded to steel work by a special gun. This gun, using a special timer, operates from a standard d-c welding unit. A 400 amp, NEMA rating will handle all roofing and siding applications. Gun may be purchased or rented on monthly basis.

Costs compiled by Leonard C. Barr, Vice President of the Nelson Stud Welding Div. for a contractors' meeting shows cost reductions from about $14.00 a square by conventional methods of installing corrugated metal roofing to about $9.00 by stud shooting. Comparable figures for siding show a reduction of from about $18.00 to $12.00 and over $1.00 for steel decking.

Experience on many jobs in widely separated sections of the country indicate that with stud welding a four man crew can lay 20 squares per day of corrugated metal roofing and 15 squares of siding. Allowing $2.50 per hour plus 10 per cent for insurance and taxes, plus, for the contractor's benefit, 70 per cent of this total for overhead gives a total labor cost of $149.60 per day.

For corrugated metal this comes to $7.48 per square for roofing and $9.97 for siding. Comparable costs using conventional straps or straps and rivets are $11.69 for roofing and $15.58 for siding. Latter costs are based on a 5 man crew laying 16 squares of roofing and 12 squares of siding per day. In addition to the lower cost, the absence of scaffolding and lack of interference with working crews are cited as important advantages especially in reconstruction work over operating crews.

The costs cited must be adjusted for local labor rates and for company

See PLANT ENGINEERING, page 26, June, 1948 issue for the other applications.

Fig. 1. **STEP 1.** A template facilitates proper location of the studs on the purlins but some prefer to spot proper locations with a punch mark. On painted members, paint should first be removed with a blunt-faced drill. The gun, weighing about 5 lb, operates from a standard welder with a special line may be purchased or rented by month

Fig. 2. **STEP 2.** With the studs installed the sheet is positioned and the studs driven through by a sharp blow with a rubber headed hammer. This particular photograph shows operation on metal decking. According to the construction figures compiled for this data listing, steel roof decking is somewhat cheaper to lay than are some other types

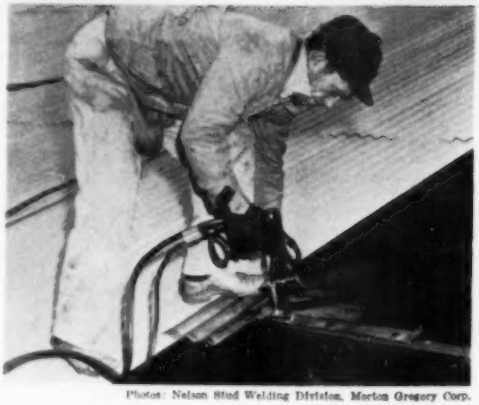


Fig. 3. **STEP 3.** Washers are slipped over the exposed end of the stud and riveted with a machinists hammer. Here a riveting tool is being used to give a better appearing job. Figure 5 shows the detailed construction of a special rivet for aluminum to prevent electrolytic action between dissimilar metals

Photos: Nelson Stud Welding Division, Morton Gregory Corp.

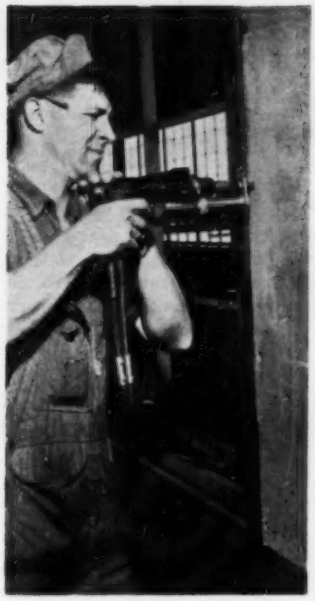


Fig. 4. On heavier formed sheets where it is not practical to drive the studs through, holes are drilled and the sheets fastened with another type of stud used in the same gun. This shows Cemesto siding installation in plant

policy on overhead where the work is done by inside crews. Figures given are based on the use of 12 ft sheets with the minimum of cutting.

The importance of geographical areas is indicated by costs supplied by the Celotex Corp. in connection with Cemesto Board. Complete costs including accessories ready for built-up roofing per square is estimated as: $70.00 in California; $63.00 in Philadelphia; $58.00 in New York; and $50.00 in New Orleans. Of these costs approximately $30.00 is for material F.O.B. factory in New Jersey. When applied to wood framing the above costs are 5 to 10 per cent lower.

Table I. Approximate fastener cost per square using stud welding methods for various types of roofing, siding and decking. Unit installation costs of various materials for comparable services differ about as the fastener cost as listed above. Conventional fasteners, clips, straps, or bolts and clips run around $2.50 per square for the first eight items, about twice this for the ninth item and about $0.15 per tack weld for steel decking

Material and Service	Fastener Cost Per Square
ROOFING	
Aluminum	$2.45
Protected Metal	1.59
Iron	1.30
Corr. Asbestos	4.95
SIDING	
Aluminum	2.45
Protected metal	1.59
Iron	1.30
Corr. Asbestos	4.95
Cemesto Board	3.68
ROOF DECK	
Steel	1.31

Referring back to earlier costs on other types of roofing, variations in the total cost of installation is dependent largely upon the variation in the cost of fastenings. Approximations of these costs for various materials is given by Table I for stud welding. As a matter of comparison conventional fasteners for the first eight types run about $2.50 per square. Aluminum roofing fasteners for stud welding are more expensive due to the composite stud used. This is shown in detail by Fig. 5.

From the standpoint of labor cost estimation for local conditions, important factors are that a four-man team can lay per day with stud welding about: 20 squares of corrugated asbestos. For siding comparable figures are: corrugated metal, 15 sq; Corrugated asbestos, 7 squares, and Cemesto 8 squares when engineered with metallic H's for battens.

Using straps, straps and rivets or clips the corresponding figures in squares per day with a five-man crew are: Corrugated metal roofing, 16; corrugated asbestos roofing, 8; For siding: Corrugated metal, 12; Corrugated asbestos, 5; and Cemesto, 6.

Steel roof decking is somewhat cheaper to lay and using 12 ft Tri-panel deck, on 6 ft purlin spacing, a three-man crew should lay 18 squares per day at a cost of fasteners per square of $0.15. Using stud welding the same crew should lay 30 squares at a cost of fasteners per square of $1.71. Using the 10 per cent of labor cost for tax and insurance and 70 per cent for overhead brings the total installation cost per square to $6.38 and $5.05 respectively.

While various materials for roofing and siding are well known, aluminum for this service is comparatively new. In service test since 1922 various forms of this material are now avaliable commercially from different sources. In many locations the long life, light live load, resistance to corrosion and heat reflectivity makes aluminum desirable.

Conforming to standard construction practice this type of material is available in corrugated form with 1¼ and 2½ in. corrugations, 0.032 in. thick and weighing approximately 56 lb per square. A lighter gauge is made primarily for form use.

In addition, aluminum is available in two other forms: sheets at the same weights with five crimps across the width of the sheet to provide sealing between adjacent sections and for expansion and contraction; and a heavy dimpled foil, the dimples making provision for expansion and contraction due to the weather and as transfer of localized stress due to underlying cracks. This foil is installed similar to mineralized surface roofing, layed in hot asphalt over felt backing.

Space limitations preclude publication of the complete cost summary mentioned. These details are, however, available in mimeographed form to those interested. Just drop a note to the Editor, or write "Roofing Costs" on the postcard to be found elsewhere in this issue of Plant Engineering.

Sheet aluminum, corrugated or crimped, is installed much the same as any corrugated roofing. The roof slope should be from 4 to 6 in. per foot, if under overlap or a mastic seal, is not used.

Special fillings, flushings and accessories are available. It is important to avoid contact with copper or water dripping from copper or iron fittings. Both tempered and annealed flashings can be obtained in roll form. Flashings can be bent to approximately 90 deg with a minimum radius of the thickness of the metals. Bends should be carefully measured so as to avoid rebending.

All parts of steel framing coming in contact with the aluminum should receive a priming coat of rust inhibitor paint with a red lead, blue lead or zinc chromate base followed by preferably two coats of aluminum metal and masonry paint.

On industrial roofs the purlin spacing should range from 7 ft 6 in. for a uniform load of 22 lb per sq in. down to 4 ft for loads up to 80 lb. With wood sheathing at least 1 in. thickness is desirable and continuous sheathing is preferable.

Where there is continuous dampness, or over green lumber, a layer of 30 lb. asphalt-saturated felt between the roofing and sheathing is desirable. The sheets should also be painted on the inside with bituminous paint or a prime coat of zinc chromate paint followed by a coat of aluminum paint. Flashings surfaces in contact with masonry should receive a heavy coat of bituminous paint.

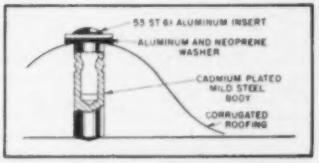


Fig. 5. Details of a composite metal stud used with aluminum sheets to eliminate electrolytic action between dissimilar metals. The neoprene washer gives a tight seal to prevent leakage

Layout and Planning of Plant Ventilating Systems

By TYLER G. HICKS
Consulting Engineer

Listing of data required for calculation of duct and fan system . . . Problem worked out on basis of typical industrial plant dining room . . . Use of duct and room layout drawings in making calculations . . . How to use tabular data in typical planning calculations for duct sizes, system static pressure, friction losses, recommended velocities, outlet velocities and fan tip speeds . . . Effect of duct sizes on costs

Part I—Industrial Cafeteria Dining Rooms

GOOD VENTILATION of industrial cafeterias is necessary for personnel comfort and health. Ventilating system planning and layout is simple after all data have been assembled and analyzed. With their complete, firsthand knowledge of cafeteria requirements, plant engineers can frequently make sizable savings in planning costs by doing the work themselves.

Data Required

To plan a good ventilating system the plant engineer must know 1—room volume, 2—air changes necessary, and 3—fan and duct sizes. Room volume is usually fixed by building construction and can be obtained by measurement. Number of air changes required depends on dining room location, above or below ground, maximum number of people in the room at the same time, and plant location. For average industrial dining rooms in Northwest U. S., 15 air changes per hour is usually satisfactory for comfort cooling; in Southern U. S., as many as sixty air changes per hour (1 per minute) may be necessary. Fan and duct sizes must be computed after the other factors have been decided on.

System Planning

Fig. 1 is a plan of a typical industrial dining room. Room volume is computed as shown in Table I. Assuming fifteen air changes per hour for summer comfort cooling and eight for winter ventilation, respective air quantities are found to be 24,750 cfm and 13,200 cfm. One fan will be used to supply all ventilating air as shown in Fig. 1. Exact arrangement depends on building construction, headroom desired, room finish, and probable duct sizes.

With the duct layout sketched the next step is determination of sizes. Most fan catalogs contain two duct sizing charts; one for finding the diameter of a round duct to convey the given quantity of air at a specified friction loss and the other for converting diameters to rectangular sizes. Assuming a 0.07 in. H_2O friction loss per 100 ft of duct to keep velocities low, as shown in Table II, the diameters and rectangular sizes are found from the charts and entered in Table I.*

Friction losses in each section of duct are then computed. The outside air entrance loss is about 1.5 heads; i.e., 1.5 x velocity pressure or 1.5 air velocity, fpm ÷ 4,006². Filter, heater, washer, and supply grille

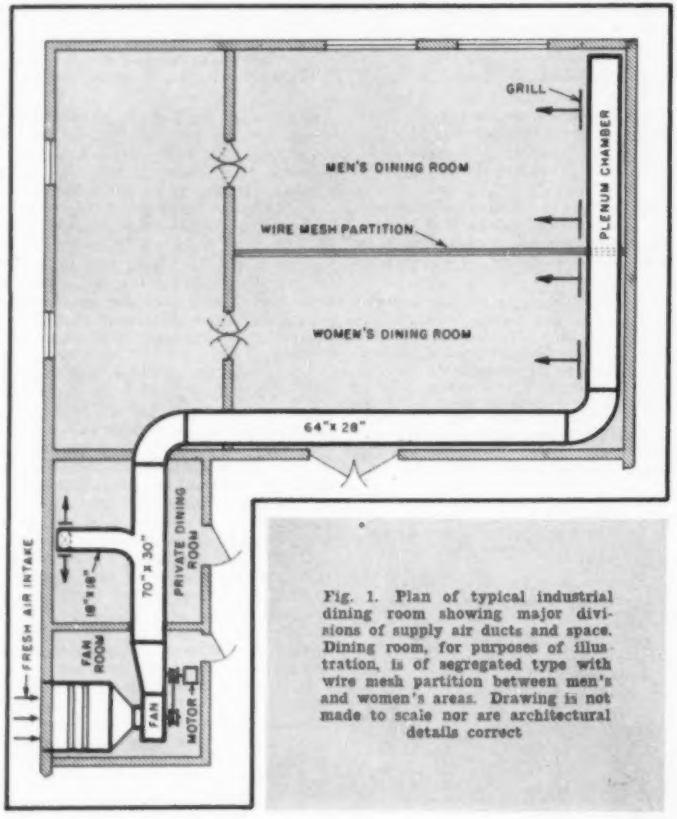


Fig. 1. Plan of typical industrial dining room showing major divisions of supply air ducts and space. Dining room, for purposes of illustration, is of segregated type with wire mesh partition between men's and women's areas. Drawing is not made to scale nor are architectural details correct

* Also, see article, "Making Air Duct Calculations Easy," October, 1948, issue Plant Engineering, page 40.

losses are obtained from manufacturers' catalogs.

Straight duct lengths can be scaled or estimated from dining room sketch. Table II summarizes elbow friction losses, from which values for the particular system can be found. Assumption of half the main duct friction loss for the plenum chamber is permissible because the air velocity decreases beyond each outlet. Summing up friction losses as shown in Table I, a fan with a static pressure of 1¼ in. and a capacity of 24,750 cfm is required. With a fan outlet velocity of 1800 fpm, about 7.25 hp would be required to drive the fan.

The calculations in Table I show that dining room ventilating system planning is simple when a fixed procedure is followed. Other factors which plant engineers must consider are initial cost of equipment, operating costs, operational noises, and space requirements. Any one of these factors may influence fan and duct selection.

With a given quantity of air, the initial cost of ducts depends on the velocities used. High velocities permit use of smaller ducts; low velocities require large ducts. With small ducts, both material and labor costs are reduced but a system sometimes is noisy as a result of high velocities. Also, fan operating costs are greater because a larger motor is needed to produce the higher velocities. Hence, where noise is not objectionable and electricity is cheap, the initial cost of ductwork can be reduced by using small sizes. Recommended duct velocities for industrial applications are given in Table II.

Low power consumption is obtained when large ducts and moderate velocities are used. Operating noise is also reduced. Decreased power consumption and noise are obtained at the expense of higher initial costs for ductwork. If duct costs are known it is possible to make a comparison of operating costs and the additional investment required for larger ducts. From these values the time which must elapse between installation and the date when power savings have "paid" for the larger ducts can readily be computed. For permanent installations, i.e. those which will be used 20 years or more, a 5 year "write off" period is reasonable.

Operational noises and space requirements are again functions of duct size. Reduced noise and increased headroom are always paid for in the form of higher operating costs when small ducts are used. Where ducts pass through storage or manufacturing areas on the way to the dining room, the additional headroom obtained with small sizes is often worth money. It is possible to compute the savings resulting from increased headroom. The advantages of reduced noise cannot, in general, be computed but the psychological effects of noise on personnel are well known. Studies by medical authorities have shown that noise is a source of fatigue and the less there is the better the comfort of plant personnel. Table III gives recommended outlet velocities.

Plant engineers are in an ideal position for planning economical dining room ventilating systems. Their complete knowledge of plant requirements and peculiarities makes them better suited for planning work than many others.

Table II. Elbow friction losses and recommended duct velocities in the system

Rectangular elbow (W-width, parallel to the elbow radius)				
Duct radius, r —	¾W	1W	1.5W	2W
Equivalent length of straight duct	35W	21W	13W	12W

Square duct elbow				
Duct radius, r —	¾W	1W	1.5W	2W
Equivalent length of straight duct	18W	10W	4W	2½W

Recommended Velocities at Various Points in System

Duct section	Velocity, fpm
Air intake	1000 to 1200
Main ducts	1200 to 2000
Sub ducts	800 to 1200
Exhaust grilles	1000 to 1200 (cooling)
Exhaust grilles	500 to 600 (normal)
Supply grilles	800 to 1000 (cooling)
Supply grilles	400 to 500 (normal)

Table I. Typical calculations for design of systems for industrial dining rooms

	Dimensions in Feet			Volume,	Air Changes		CFM	
	Length	Width	Height	Cu Ft	Winter	Summer	Winter	Summer
Private room	30	25	12	9,000	8	15	1,200	2,250
Men's area	75	50	12	45,000	8	15	6,000	11,250
Women's area	75	50	12	45,000	8	15	6,000	11,250
Totals for dining room				99,000			13,200	24,750

Duct Sizes

Duct section	Maximum CFM	Friction, in. H_2O	Round duct diameter	Rectangular
Fan discharge	24,750	0.07	49″	70″ × 30″
Men and women's area	22,500	0.07	46″	64″ × 28″
Private room	2,250	0.07	20″	18″ × 18″

System Static Pressure in Inches H_2O

Outside air entrance loss — $\left(\frac{1,200}{4,006}\right)^2 \times 1.5$		— 0.135
Air filters		— 0.200
Heater		— 0.180
Air washer		— 0.220
Supply grille		— 0.050
15 ft of straight duct to fan inlet	— 15 ft	
110 ft of straight duct to plenum chamber	— 110 ft	
2 Elbows R-1.5W, 64 in. × 25 in. — 2 × 13 × W $\frac{2 \times 13 \times 64}{12}$	— 139 ft	
	264 ft	
264 ft of straight duct at 0.07 in./100 ft		— 0.185
100 ft of straight duct in plenum at 0.035 in./100 ft.		— 0.035
		1.005
10 per cent safety factor		— 0.101
		1.106
Fan static pressure —		say 1¼ in. H_2O

Table III. Outlet velocities and fan tip speeds for quiet operation

Fan static pressure, inches water	Outlet velocity, fpm	Tip speed, fpm
¼ in.	1100	1500
½ in.	1200	2000
¾ in.	1500	2500
1 in.	1800	29000
1¼ in.	2000	3200
1½ in.	2200	3500

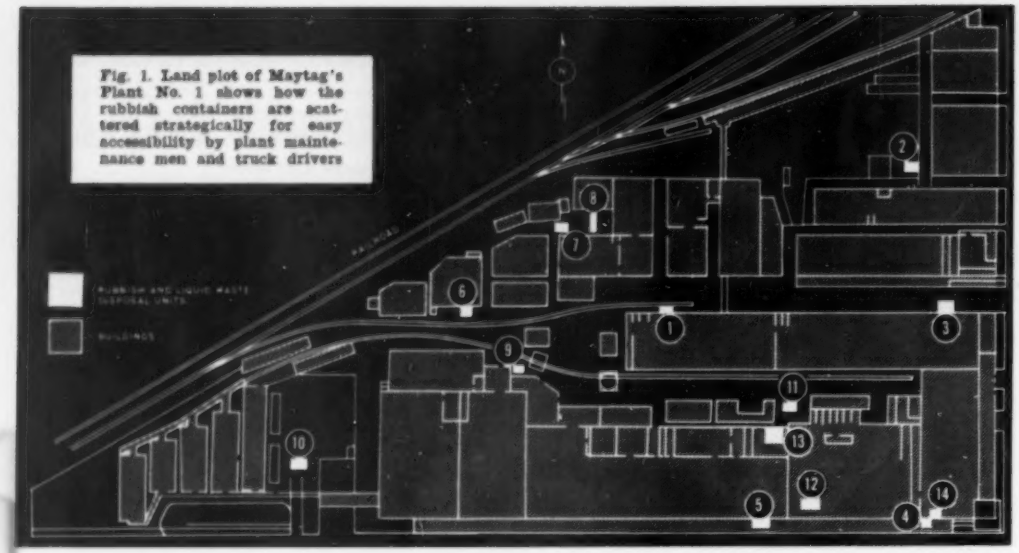


Fig. 1. Land plot of Maytag's Plant No. 1 shows how the rubbish containers are scattered strategically for easy accessibility by plant maintenance men and truck drivers

Modern Rubbish Disposal

—2 Trucks Do What 5 Used to Do

Twenty-two containers of eleven different types, holding liquid and solid wastes are saving money for Maytag Company in Newton, Iowa . . . This progressive manufacturer of home appliances has found that two modern trucks with one driver apiece can do what five trucks and three men per truck were able to accomplish, formerly . . . Improved yard appearance

WITH THE ADDITION of the $5,000,000 plant for the production of Maytag automatic washers to the increasing production facilities of The Maytag Company at Newton, Iowa, the problem of accumulated waste materials and their removal from the two plants became a serious concern to Maytag officials.

As early as 1944 Maytag was considering a better way of collecting and removing waste materials from the plant, thereby eliminating two obsolete open trucks which were unable to effectively handle the increased load.

Then, upon construction of the new automatic plant northeast of the city, Maytag men knew that a new system would have to be seriously considered and installed, and engineers from the Dempster Company at Knoxville, Tenn., were called upon to submit a survey of the need at Maytag. That was on August 6, 1948.

Today, twenty-two of this company's containers are scattered in selected spots at both Maytag Plant 1 and Plant 2, and two Ford S-7 trucks are kept busy eight hours a day running the waste liquids and solids to the two refuse depots in the city. The two trucks are doing today what five did less than a year ago. Recently one of the open trucks was destroyed by fire at the local dump and provided one more logical reason for a new system of removing the Maytag waste products.

There are 11 different models of these rubbish carrying containers at the two Maytag plants. Fourteen are located strategically at Plant 1 and eight are placed at Plant 2. Five of the containers are for liquid waste only and all types of liquid waste are poured together and dumped at a reserved area in the Maytag refuse depot.

Constructed of heavy gauge steel, the containers vary in size from 3 to 10 cu yd. When the equipment is in full operation at the Maytag plants, soot, waste paint sludge, all oils and even snow will be handled by the equipment. At present, waste paper, scrap metal sweepings and other trash are accomodated by the units.

The containers are plotted near departments where they are easily accessible and where they can receive the greatest volume of waste. A smooth floor is the only requisite for the container's base. No special platform is needed for the equipment.

At regular intervals the containers are inspected by the yard crew at Maytag and the operators of the trucks are notified which containers are ready for emptying. The truck is backed up to the unit and two large chains are attached to the boxes from the equipment on the truck. By moving two hand controls inside the truck cab the box is lifted into place and rested back in a cradle on the truck bed. The containers are emptied at the local dump in as simple a manner. Duo rear wheels on the trucks aid in pulling the truck out of soft ground at the dumping area.

According to the maintenance men, at Maytag any make and model truck can be fitted with this equipment. The Ford trucks purchased by Maytag were secured from a dealer

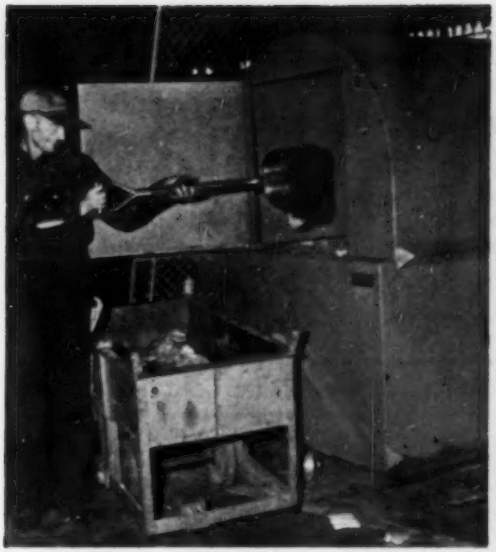


Fig. 2. Handloading a container from a small cart at Maytag's automatic washer factory. A fork truck lifts the container from its position to the loading dock where the Ford truck lifts and takes it away to the trash depot for emptying

Fig. 3. A driver inspects the top lid on one of the containers preparatory to hoisting it into position on the truck. When the container is returned, the refuse on the ground is shoveled into the box and the area is left neat and clean

near the Dempster factory at Knoxville so that the installation of the equipment could be facilitated.

The survey made by the manufacturer of the dumping equipment, for The Maytag Company, showed that the equipment in use at Newton, Iowa could pay for itself in two years. This, of course, did not include the purchase price of the trucks.

One of the most advantageous features of the equipment is that big saving of man power in hand loading. One man can operate the equipment and he never touches the waste material. The previous method required two or more men to handload the open trucks and another man to drive the dump truck to the refuse depot. And all the while this truck was being loaded it was tied-up and could not be used for other purposes.

Another feature of these containers is that the fire hazard is reduced through storing combustible and inflammable refuse in all-steel, fully-enclosed bodies. Should a fire occur in materials stored in these containers, that fire could be smothered out or confined to the one small area.

No small consideration is the fact that the general plant appearance is improved by confining the waste paper and other unsightly waste to a neat, confined, fully-enclosed body. The accumulation point is clean and the waste is not scattered by wind and mechanical means. Personal injury hazards are eliminated also. There is no physical lifting on the part of yard personnel.

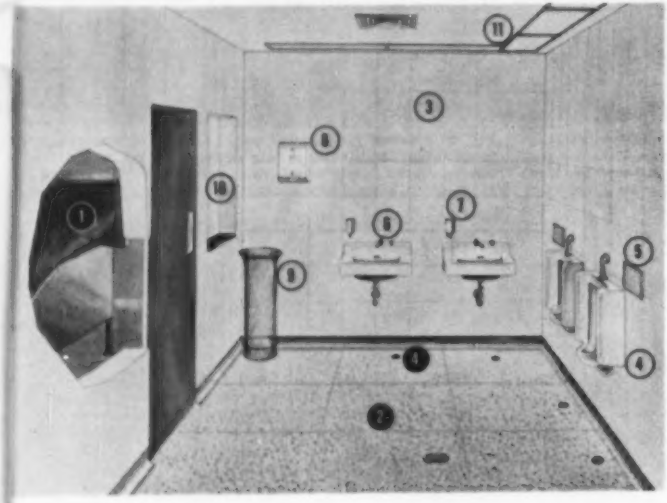
Fig. 4. Here a load of miscellaneous solid trash is dispersed at the city dump. This particular container empties from the bottom. There are 11 styles of containers at Maytag ranging in capacity from 3 to 10 cu yd. Besides trash the containers can be used for snow removal, liquid wastes, ashes, waste foundry sand

"Watch the Details" Secret of GOOD WASHROOM PLANNING

Modern equipment, methods and material are available to make the industrial washroom an economical element in your plant's sanitation set-up . . . Refinement of details such as ventilated lockers, foot-flush lavatories and urinals, stainless steel washfountains, recessed fluorescent lighting, easily cleaned walls are a few of those listed here

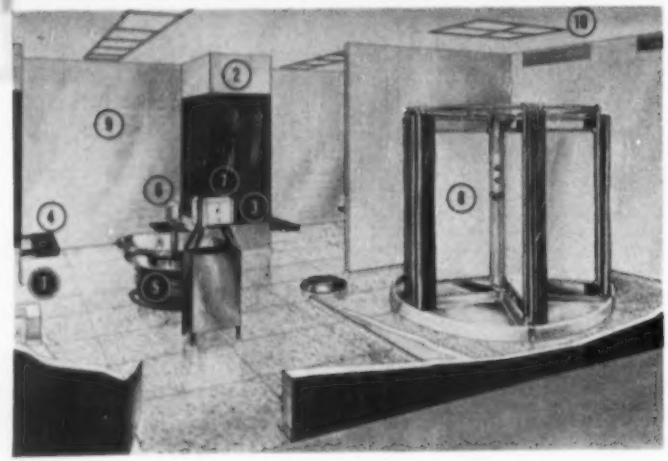
By W. H. DeVORE, Director, Washroom Advisory Service, Scott Paper Co.

Check List for Details of Small Lavatory and Toilet



1. Entrance shielded from work areas.
2. Floors of terazzo (tile or concrete) are impervious to moisture and, sloping down toward the drain, are easily cleaned by mopping or hosing down.
3. Walls are of glass, tile or other materials impervious to moisture. Walls and floors coved at juncture.
4. Urinals and lavatories are wall-hung with foot-control water valves. (Users dislike touching manual valves).
5. Exhaust vents are above fixtures.
6. Lavatories have single faucet for hot and cold water mixing.
7. Soap dispensers project over left side of basin. (Soap droppings fall on basin rather than floor thus obviating safety hazard.)
8. Tissue towel dispenser away from basin enroute to exit.
9. Waste receptacle with large open top continues facilities progression.
10. Recessed mirror, shelf and light continue progression. User is now at exit and each facility has been freed for successive users.
11. Proper illumination provided over facilities by recessing fluorescent lights in ceiling.

Check List for Locker Room, Shower Room and Washroom



1. Lockers are mounted on terrazo or cement islands, minus legs, and flush.
2. Mechanical ventilation via fresh dry air intake above locker, drawn through perforated ceiling, and through floor plates to exhaust duct.
3. Locker floor plates are inclined and provided with shoe cleats.
4. Benches are off floor, projecting from locker island.
5. Circular stainless steel washfountain accommodating 8 to 10 persons. Has foot-ring water control.
6. Soap dispenser on washfountain.
7. Combination towel dispenser-waste receptacle unit to accommodate heavy traffic.
8. Circular showers for five users is equipped with colorful, plastic shower curtains.
9. All walls of tile or glass, impervious to moisture.
10. Ceiling recessed lights are directly over shower.
11. Recessed mirror with shelf and light (not shown).

Check List for Service Sinks, Supply Closets, Toilets

1. Wall hung toilets with foot flush valves.

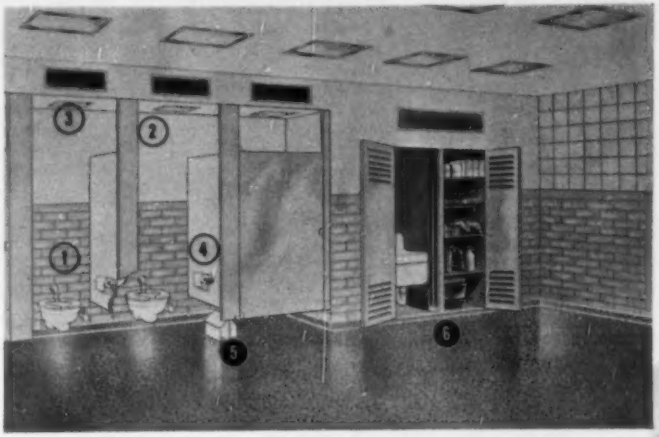
2. Toilet partitions are ceiling hung to permit greater ease of cleaning and to facilitate circulation of fresh air.

3. Each toilet booth is illuminated with ceiling-recessed lights.

4. Roll toilet tissue is dispensed from a sturdy fixture that prevents the roll from spinning and also discourages theft.

5. Sanitary napkin waste receptacle serving two compartments permits privacy and obviates disposal via the toilet in women's rooms.

6. Supply closet and service sink are in locked compartments. Pilferage of supplies and promiscuous, haphazard open-placement of cleaning equipment in personal service rooms is avoided. Inefficient, time-consuming traveling of great distances by the janitor for supplies and equipment are no longer necessary.



CUMULATIVE EVIDENCE discloses that sanitation labor and administrative costs consume from 85 per cent to 95 per cent of an organization's total sanitation budget. Since hourly wages are fixed, how, then, may economies be effected? The basic answers to this $64.00 question are three: First—Effective control of the janitorial staff's work hours and duties; Second—Buy products and equipment that perform best. Price buying is extravagant buying. Performance combined with price establishes value; Third—Provide well-designed, modernly-equipped, personal service rooms. Savings effected in maintenance man-hours alone contribute materially to amortizing the costs of such rooms in a reasonably short time. Old, worn, dingy washrooms discourage janitor and user alike, with resultant high costs.

As an example of refinement of details now available in modern personal service rooms look at Point No. 2, in Fig. 2. The ventilation of individual lockers may seem of small import to people who are not working in dust, dirt and fume-laden atmospheres. Odors cling to clothing which have been hung in the lockers; also, washrooms odors, regardless of the degree of sanitation and cleanliness employed, will persist. In the lockers pictured the doors are without louvers so that the washroom air does not pass through or over the clothing nor are locker odors, on the other hand, expelled into the washroom. Note that exhaust vents in the island draw humid stale air from the washroom.

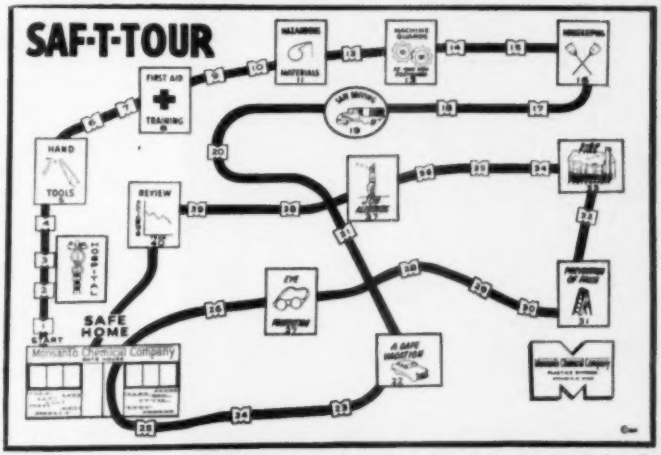
The third factor mentioned above —modern equipment—is the factor discussed in the captions accompanying the three illustrations. But, there is more to careful planning of personal service rooms than can possibly be contained in this allotted space. It is hoped, however, that these two articles* will have stimulated greater cognizance of the importance of good, modern, personal service rooms to better employee relations, and more efficient housekeeping and maintenance. Many industrialists as well as sociologists predict that the last half of the Twentieth Century will see great strides made in the field of human relations. Good washrooms are essential not only to such relations but to good business as well. An evaluation, in 1950, of your company's personal service facilities may establish an important milestone in your company's progress.

*The first article appeared on page 56, April issue of PLANT ENGINEERING.

Mr. DeVore states that Washroom Advisory Brochures, prepared by authorities, are available upon request. Simply drop a line to The Editor, Plant Engineering, 110 S. Dearborn St., Chicago 3, Ill., or write "Washrooms" on Postage-paid card elsewhere in this issue.

Playing It Safe, and Making It a Game

Contributed by Monsanto Chemical Co.



Here is a novel and dividend-paying game which has been developed by the Safety Committee of the Plastics Division of Monsanto Chemical Co. Saf-T-Tour, a game based on the familiar Parcheesi-type contest, is a new way of teaching the employees the importance of being safety-conscious

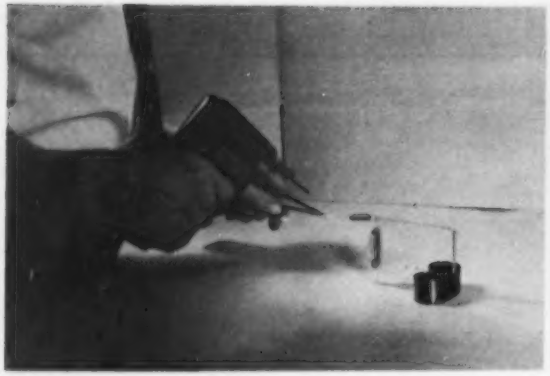


Fig. 1. Demonstrated here is the spring's ability to utilize characteristics of clamping and support to help in an assembly job

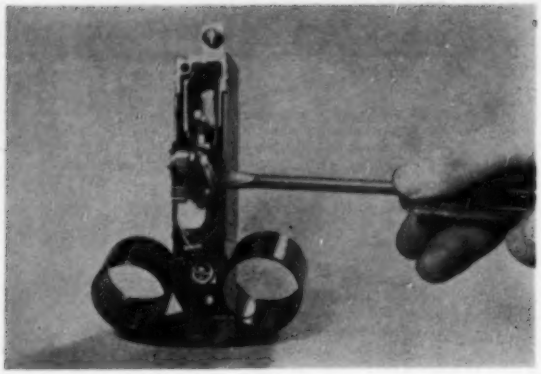


Fig. 2. The neg'ator clamp is set up in this photo to act as a vise for holding objects during assembly or adjustment operations

. . . as a clamp . . . as a hanger . . . as a

Described unromantically as "the first elastic member in history to exhibit negative or constant force-deflection characteristics," to the plant engineer it is a spring with its sleeves rolled up, ready to tackle anything it can set its coils on . . . Some of its features: automatic take-up, enormous extendability, flexibility to fit work, constant pressure regardless of thickness of work to be clamped, and long life

Fig. 5. In this instrument set-up many wires must be used to make variable connections from one point to another

A NEW AND UNIQUE industrial clamp named the "neg'ator clamp," for maintenance, production, laboratory and display use throughout industry has been developed. It possesses six notable characteristics:—1, automatic take-up; 2, constant clamping pressure regardless of the thickness of the object held; 3, enormous dimensional range between clamp heads; 4, full clamping pressure inherent in single part (without externally applied forces); 5, extreme flexibility in locating clamping pressures (head pressures need not always be opposed); and 6, coil-form heads or jaws (can act as cord or tubing guides or as a base for freely supporting the clamped object).

It is reported that the clamps are currently available in standard sizes to cover a range of clamping pressures from 2 oz to 20 lb in 8 increments. In breadth they range from ¼ in. to 2 in. Special pressures and sizes are available upon a development basis.

The neg'ator clamp offers to clamp or vise users for the first time a means of knowing at all times the pressures with which work-pieces are held together—and of selecting that pressure.

The device has a seemingly unlimited number of applications. It can be used as a holder for anything from brooms to tools to books; as a jig for positioning component parts during welding, stenciling, drilling and gaging; as a vice-clamp for gluing, bonding and fitting work; as a hanger for pipe and wire; as a guide for cable and cord; as a base for edge-supported flats; and any of a thousand other everyday clamping needs.

The neg'ator clamp is fabricated from flat spring stock by a prestressing process. Prestressing the

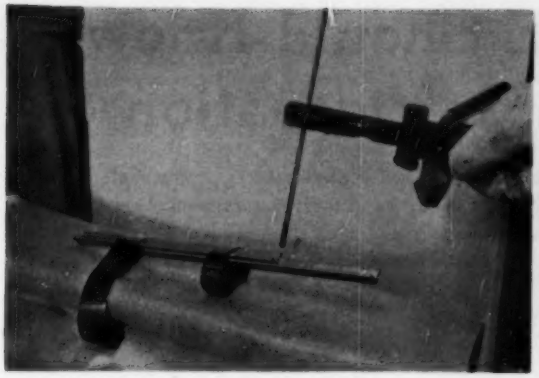


Fig. 3. This fixture of neg'ator clamps is holding two pieces together for welding and also holding both of them on work surface

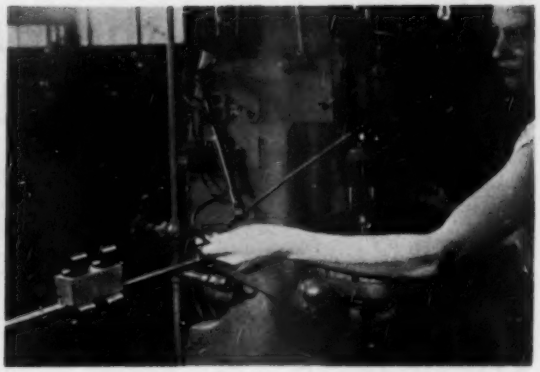


Fig. 4. In this production operation the clamp is used to hold a length gage stop in proper position for cutting of flat spring stock

holder...and as a vise

Plant Engineering
Product Application Feature

...That's the Neg'ator

spring stock causes it to roll up into a solid coil (each turn of the coil pressing tightly against the next smaller). The clamp is then formed by winding off approximately half of this coil to form another coil—the two being connected by a relatively straight section of the prestressed stock. The force between the coils is developed because the ends of the straightened section try to return to the natural coil form. The intensity of the clamping force depends on the thickness and width of the material plus the amount of prestressing of the flat material.

In the free position, the coils of the clamp are in forced contact. Therefore, when using the clamp an external force is necessary to separate the heads. At the instant this opening force is removed, take-up is automatic, thereby eliminating ake-up screws or levers. Full clamping pressures, further, exist at the instant the opening force is relieved. Screw-type or wedge-type clamps, on the other hand, necessitate a gradual application of force.

Another unique property of the neg'ator clamp is its great expandability between heads. The possible distance between heads is limited only by the length of material prestressed. The coil form permits long length to be stored in relatively small dimensions.

This tape-like character of the material between the two coils can be utilized to go around corners and follow other circuitous paths. The head connections of the usual clamp is rigid.

Over and above the clamping properties of the device, the coil form of the heads can be utilized as guides. Such guides are useful in keeping welding cable or temporary wires off the floor.

Want more information on the neg'ator? Just write it on one of the postage paid cards elsewhere in this issue.

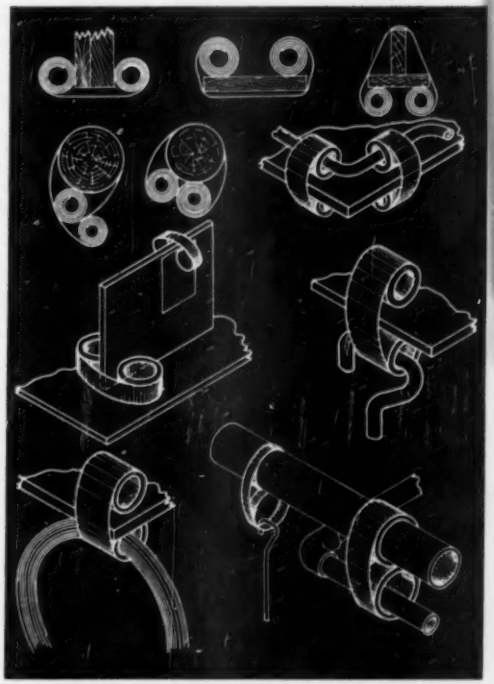


Fig. 6. Many of the outstanding uses of the neg'ator clamp: from clamping, to holding cord, to pipe supports

Some Facts the PE Should Know About Centrifugal Refrigeration

Size limitations . . . High speeds . . . Loss of performance . . . Test factors for checking performance . . . Application of these factors in practice . . . Thirteen basic factors in performance and what they mean . . . Types of drives . . . Validity of prime mover test curves for test work

By **HAROLD WOODHOUSE**, Executive Engineer

NATURAL ABILITIES of the centrifugal compressor to handle large volumes of vapor, with the upper limit of its speed dependent on the characteristics of the vapor in the system rather than the mechanical limitations of the compressor, has resulted in the universal adoption of the centrifugal refrigerating unit for large capacity installations.

This coupled with the mechanical simplicity and reliability of this form of compressor together with its adaptability to electric drive, or turbine drive where energy from process steam is available, makes its selection almost mandatory for such installations.

It is interesting to note that while several manufacturers consider 100 t capacity the minimum size for which the inherent qualities of the centrifugal compressor make it superior to the reciprocating unit, it is possible to purchase commercial centrifugal systems for as low as 60 t nominal rating, with actual test ratings for particular conditions even under 40 t. At the other extreme with super-installations of say, 10,000 t, the axial flow compressor is expanding its field of usefulness from current well publicized gas turbine and jet engine applications to supplant even the centrifugal compressor.

Engineers unfamiliar with the manufacture of high speed rotating machinery stand in awe of the speeds at which these machines run. About 3,500 rpm is the speed at which many direct coupled electric driven centrifugal compressors run. This is about the upper limit of normal operation for most reciprocating type engines or compressors. Many centrifugal refrigerating installations use setup gears between the drive and the compressor and speeds of around 7,000 rpm are common. In addition, the theory of the centrifugal compressor is much more complex than that of a reciprocating unit. It is easy to visualize a gas or vapor filling a cylinder of known dimensions a definte number of times a minute so that a rough check can be made with an assumed volumetric efficiency factor.

Relatively few plant engineers have made an intensive study of centrifugal compressors so few feel familiar with the factors which influence performance and how these factors operate to change the compressor output. It is not surprising that the engineer responsible for the maintenance of a centrifugal system installed in, say a chemical process plant, has in general a relative, rather than a specific knowledge of the performance of the equipment.

Ordinarily he is acutely conscious of a deterioration of mechanical operation such as ball bearings or gears—since undue noise may presage a complete shutdown, which means working day and night until the unit is running again. A slow decline in refrigeration output, resulting conceivably from oil coating the evaporator and condenser tubes and cutting down the heat transfer rate, is not likely to bring on anything more urgent than protests from production.

The plant engineer is more likely to say "We don't seem to be getting as much refrigeration out of the unit as we were when it was new" than to be specific and say "When it was new we were getting 115 t of refrigeration at specified conditions and 1.030 hp per ton. Now we are getting only 95 t at 1.115 hp."

To analyze specifically the performance of a motor driven centrifugal refrigeration unit as a whole without detailed analysis of the component elements requires:

1. Instruments for measuring accurately the motor input and motor test curve.
2. Flow measuring devices for obtaining the condenser cooling and evaporator cooled liquid flows.
3. Thermometers and thermometer wells for measuring temperatures at specified points.
4. Gas tables or curves of the refrigerant used, usually Freon 11 or Freon 113 in modern installation.

Item 1 should present no difficulty for it is simple to measure the input, and a motor test curve can be obtained from the supplier of the unit or the motor manufacturer.

Item 2 usually presents the most difficulties. Liquid or gas flows are measured by the use of venturis, nozzles, or orifices, with the venturi recommended for greatest accuracy. A properly designed installation would have measuring devices[1] incorporated at necessary points as a permanent feature of the system.

If the installation has not been provided with permanent flow measuring devices, orifices are the simplest to add to the existing piping system. Since the unit must have been given a test before shipment, thermometer wells should be found at all necessary points.

When the system is tested in the manufacturer's shop before shipment, water is used for both the cooling and the cooled liquid in evaporator and condenser. In service, the cooled substance may not be water so that in calculating evaporator and system capacities a factor for the specific heat of the cooled substance must be used. If it is water, this factor will be 1.0 and may be ignored.

Test measurements necessary to analyze the performance of the typical centrifugal installation are indicated in Fig. 1. They are needed for evaluating the basic quantities, ratios and values listed below and which are generally used for rating the performance of this type of equipment:

1. Indicated Coefficient of Performance.

For a refrigerating machine this is analogous to the efficiency of a heat engine and is the ratio of the heat received by the machine from the body that is being cooled to the net work received. It may also be said to be the ratio of the refrigerating effect to the work of compression. No machine can have a higher coefficient of performance than a perfect machine operating on a Carnot cycle. In this cycle the efficiency is dependent only on the extreme upper and lower limits of tempera-

[1] Flow formulae have been omitted since they are readily available in handbooks. One of the most complete is "Flow Measurement" (by means of standardized nozzles and orifice plates) obtainable from the American Society of Mechanical Engineers, 29 W. 39th St., New York, N.Y. The price is $2.75 per copy.

ture, which are those of the condenser and evaporator.

For example, the coefficient of performance of the perfect machine operating on a Carnot Cycle, which is completely independent of the refrigerant, with upper and lower temperature limits of 86 F and 5 F respectively is 5.74. For a normal practical cycle operating between the same temperature limits the coefficient of perfomance cannot be higher than 4.85 for ammonia; 4.1 for water; and, 2.56 for carbon dioxide.

According to these figures ammonia is superior to water or carbon dioxide as a refrigerant if coefficient of performance were the only criterion of worth. In practice it is not the most important factor in determining the selection of a particular refrigerant. Always very important considerations are the operating pressures and volumes of the refrigerant.

The pressure of the vapor may be so high that the mechanical problems involved, such as providing adequate strength of the parts under pressure and designing ingenious and practical shaft seals become acute. If the refrigerant used dictates the use of a high vacuum the sealing problem remains even though the stresses may generally be less.

Actual volume of the refrigerant vapor required to cause a given amount of refrigeration (not the specific volume of the vapor but the actual volume of vapor to be handled per ton of refrigeration) determines the size of machine required. The larger the machine the greater the cost of the unit and the investment for its installation and accommodation.

2. Weight of Refrigerant Changed from Liquid to Gaseous State in Evaporator.

This is evaluated from the total change in heat content of the cooled liquid flowing through the evaporator each minute divided by the refrigerating effect per pound of refrigerant.

This value must agree with that obtained for the weight of the refrigerant undergoing change of state from gas to liquid in the condenser as described in Section 3. If the difference between those two weights is greater than 0.5 to 1.0 per cent of the mean value the test run should be repeated. If a careful repeat run fails to produce agreement, the test setup should be carefully scrutinized, particularly with reference to the manner in which the flow measurements are obtained.

In connection with obtaining reliable test pressures, a warning may be given against the use of plastic manometers on high vacuum units such as a Freon-113 installation. When they are used, it is disturbing to note immediately after bringing the unit up to an operating point, that the insides of all manometer tubes under vacuum appear to have small pin points of air or vapor throughout the mercury column. Another disadvantage of plastic manometers is that, where the vacuum may be in the order of 24.6 in. HQ 1 may collapse like a drinking straw with too much suction applied to the drinking end.

3. Weight of Refrigerant Changed from Gaseous to Liquid State in Condenser.

This is determined from the total change in heat content of the condenser water flowing each minute divided by the change in heat content of the refrigerant. As mentioned before this must agree very closely with the value obtained for the weight of liquid changed to gas in the evaporator as described in Section 2. Any appreciable deviation must be investigated.

4. The Refrigerating Effect.

This is the difference between the enthalpy, or heat energy, of the vapor at compressor suction conditions and the enthalpy of the condensed warm liquid refrigerant in the condenser.

It will be observed here that the refrigerating effect is assumed to cover a phase change from vapor to liquid. Although a phase change is not imperative to the obtaining of refrigeration it may be taken for granted that any commercial installation does use a volatile liquid involving a phase change. The only significant modern deviation from this practice is in aircraft cabin pressurizing and air conditioning.

If we consider a refrigerating cycle operating between the standard refrigerating temperatures of 5 F evaporation and 86 F condensing the refrigerating effect for air is 20.2 Btu per lb. Table I gives the refrigerating effect for most of the volatile liquids which have been used.

Table I. Refrigerating effect of several of the more common refrigerant types

Refrigerant	Chemical Symbol	Ref. Effect —BTU/lb.
Ammonia	NH_3	474.4
Carbon Dioxide	CO_2	64.5
Sulphur Dioxide	SO_2	141.4
Ethyl Chloride	C_2H_5Cl	142.5
Methyl Chloride	CH_3Cl	143.4
Methylene Chloride	CH_2Cl_2	134.1
Freon 11	$CF\ Cl_3$	67.5
Freon 12	CCl_2F_2	51.07
Butane	C_4H_{10}	149.4
Propane	C_3H_8	142.0

Tabulation of this one characteristic shows the enormous advantage to be obtained by the use of a vapor cycle in preference to air. It does not indicate one additional quality that makes most of these vapors so attractive for use in refrigeration, their increased specific density over that of air which has the effect of reducing the volume of refrigerant to be handled per ton.

5. The Work Done by Compressor.

Work done on the refrigerant is the difference between the enthalpy of the vapor at the suction conditions and the enthalpy of the vapor at the compressor discharge conditions.

6. Indicated Horsepower Output of the Compressor.

This is the power received by the refrigerating cycle from the compressor, measured on a thermodynamic or Btu basis, and is the product of the measured averaged refrigerant weight flow in pounds

(Turn to page 66)

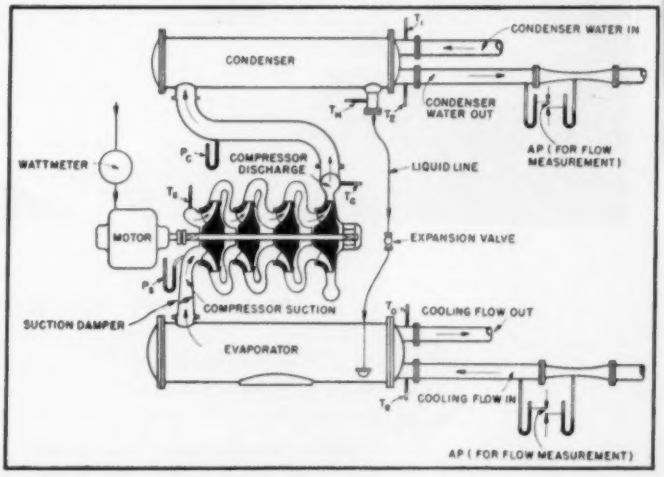


Fig. 1. Various points for taking test measurements which are necessary for detailed performance analysis in a centrifugal refrigeration installation

YOU CAN BE **SURE**.. IF IT'S

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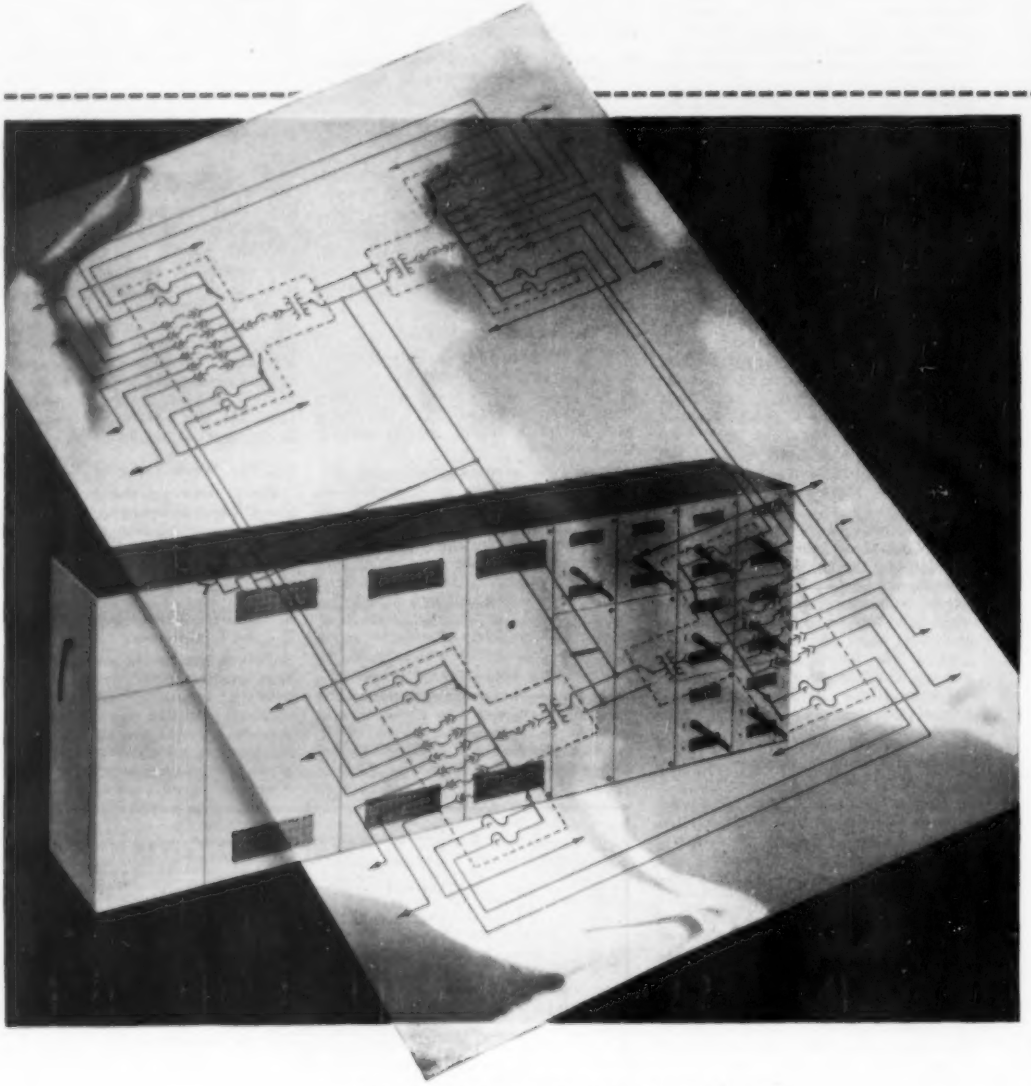

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POWER CENTERS

(From page 63)

through the evaporator and condenser, multiplied by the work done by the compressor,—in Btu on each pound of refrigerant vapor, divided by the constant 42.4. This constant converts Btu per minute to hp.

It will be observed that this is the power received by the vapor cycle and it is less than the actual or input power supplied to the motor, turbine or engine driving the compressor, by an amount equal to most of the losses incurred by both the driving element and the compressor. The difference does not cover all of the losses because some of them, such as that caused by impeller windage and friction, pass into the refrigerant vapor as heat.

There is the special case of the electric motor driven compressor where both motor and compressor are hermetically sealed in either the evaporator or condenser shell. The power losses incurred by any motor and compressor reappear as heat; bearing losses heat the oil; windage and friction losses of the compressor impellers heat the refrigerant vapor; rotor windage and core hysteresis losses heat both motor rotor and stator.

Since, in the case of the hermetically sealed unit, all of these losses pass into the refrigerant vapor as heat and thereby increase the work of compression, the indicated horsepower in such a case becomes virtually indentical with the total power input, or brake horsepower being delivered to the driving element.

It should be very carefully noted that the conception of theoretical, or indicated horsepower, and brake horsepower as used here for consideration in connection with refrigeration cycles is the opposite of that which is commonly understood for other power applications. There the indicated, or theoretical, horsepower is generally the input power, which includes all losses, and the brake horsepower is the output with all losses deducted.

7. The Indicated Horsepower per Ton of Refrigeration.

The horsepower output required for each ton of refrigeration is of far greater interest to the practical engineer and is very much more used than the term coefficient of performance which is of a more basic theoretical nature.

8. Mechanical Efficiency.

This is the ratio of the indicated horsepower to the brake horsepower. As previously mentioned, the indicated horsepower will be, in this case, the power received by the vapor cycle from the compressor measured on a thermodynamic or Btu basis whereas the brake horsepower is the total power measured at the input side of the motor.

It has been pointed out for the case of the hermetically sealed unit that all of the losses pass into the vapor cycle as heat, so for this type of installation the apparent mechanical efficiency will be very high. This does not mean that this form of installation is more efficient than one having the motor and compressor externally located for it can be shown that theoretically it should be less. The effect is to reduce greatly the normal spread between the values of the indicated and brake horsepowers by dragging down (in an efficiency sense) the indicated, close to the brake, horsepower figures.

The motor efficiency is known from the manufacturer's test curve and for any form of installation the adiabatic efficiency of the compressor is the best criterion of performance for that element of the unit.

9. Actual Horsepower per Ton of Refrigeration.

This is readily seen to be the indicated horsepower per ton of refrigeration increased by the ratio of the brake to the indicated horsepower, or, in other words, divided by the mechanical efficiency. Here, again, the previous remarks relating to external and hermetically sealed compressors will apply.

10. Over-all Coefficient of Performance.

This is the ratio of the measured refrigerating output of the evaporator to the brake horsepower put into the installation. Since maximum coefficient of performance is desirable, the mechanical efficiencies of both motor and compressor and the adiabatic efficiency of the compressor should be high since it is directly proportional to these efficiencies.

11. Compressor Adiabatic Efficiency.

This is measured by the ratio of the increase in enthalpy of the vapor from suction to discharge conditions (if the compression were completely adiabatic) to the actual increase in enthalpy. In other words it may be described as the ratio of the increase in heat energy of the vapor, with compression being performed by a perfect machine having no losses and no transfer of heat occurring to or from the vapor to any outside source, to the actual increase in heat energy of the vapor.

This ratio is measured on a Btu basis, but since each value is concerned with only one pound of the vapor it may also be stated in terms of temperature rises. When this ratio is put on a temperature rise basis it is the term 'temperature rise ratio' which is very much used in the testing of high speed centrifugal compressors as used for gear-driven aircraft engine superchargers, turbosuperchargers, jet engine and gas turbine compressors, which handle air or air with a small percentage of gasoline vapor. It is distinctly a term referring only to the efficiency with which the gas or vapor is compressed.

This ratio is of fundamental importance as it is the basic figure which determines how much money is being spent for useful refrigeration and how much is being wasted in producing unwanted heat. The over-all efficiency of a large electric motor is generally over 90 per cent so that the total loss is small and the probability of improvement negligible. For that reason its losses are ignored here. The multi-stage centrifugal compressor is a horse of another color as far as efficiency is concerned for the range of adiabatic efficiency may be anywhere from 52 to 65 per cent.

One might inquire why such a low figure when it is known that compressors used for aircraft have repeatedly given adiabatic efficiencies of 84 per cent and more. There are three main reasons: a. The quality of workmanship in a commercial refrigeration unit is not of aircraft quality. High efficiency demands strict attention to: quality of metal surface finish for rough case surfaces cause flow turbulence; proper proportioning of all flow passages; and absence of protrusions, depressions and sharp changes of direction in both stationary flow passages and the rotating impellers. b. While the tip speeds, ranging from 330 to 450 ft per sec of impellers used in commercial centrifugal compressors, would not appear to be high, they are nevertheless high enough to cause losses from what is known as Mach number effects. Many tests have shown that whenever the speed of rotation or velocity of flow approaches the velocity of sound there is a falling off of efficiency.

For normal temperatures the velocity of sound in air is roughly 1100 ft per sec and for this velocity the Mach number is 1. For the Freons now generally used in refrigeration a Mach number of unity is reached at normal operating temperatures with a velocity of only 380-420 ft per sec. c. The high velocity vapor leaving a centrifugal impeller must be slowed down and its kinetic energy converted into pres-

(Continued on page 98)

Formulae for calculation of test results mentioned are available. While these are not unduly involved, space considerations preclude inclusions with this article. They can be obtained in mimeographed form without obligation by readers. Address a letter to the Editor or write "Refrigeration" on the postcard.

Traffic Cops of the RPM

Quality of product very often depends on maintaining proper speed of production machinery . . . Here is a brief review of the various types of speed measuring instruments available to any plant . . . Some of them are portable while others are installed; some are recorders, others are read directly, but all of them are designed to help you maintain rigid control of machine, flywheel or speeds of any moving equipment

By KARL F. KIRCHHOFER

Fig. 1. Cutmeter is one type of speed measuring device designed to read directly in feet per minute. No computations, timing or stop watch necessary

EVERY PLANT engineer recognizes the necessity of maintaining a constant control over the running speeds of equipment, for many operating and manufacturing costs are based largely upon equipment speeds. It is well known that if the revolutions per minute of machinery are not maintained the quality of the product may be affected and inferior goods may be the result.

There are various speed-measuring instruments available for measuring practically all speeds of every type of equipment. Hand tachometers are speed-measuring instruments that show at a glance the revolutions per minute of a running shaft without timing, counting or calculation. These tachometers are portable instruments and operate on the centrifugal principle. They are manufactured in various speed-ranges and are in general use in all kinds of shops, plants and factories. They are also standard equipment in many educational, technical and research laboratories.

Usually, a tachometer will run three, four or five ranges and a change in range is obtained by the knurled rim. For example, a typical tachometer with five speed ranges will be calibrated to read from 30 to 120 rpm, in the first range, from 100 to 400 rpm in the second, from 300 to 1200, from 1000 to 4000 and from 3000 to 12,000 in the higher ranges.

Hand tachometers are actually precision instruments which give the operator an accurate and reliable revolution per minute count quickly.

The hand tachometer is provided with a 6 in. circumference rubber wheel so that surface speeds in feet per minute on cutting tools, paper machines, belts and other equipment may be quickly obtained. These instruments are anti-magnetic and remain unaffected by magnetic fields surrounding generators, motors and ignition systems.

Many engineers prefer the chronometric speed indicator which is a compact instrument giving rpm over a period of three or six seconds, depending on the model. This gives readings in revolutions per minute directly without any calculation whatever. The instrument need not be watched or read while it is being applied. It stops automatically at the correct speed after three or six seconds and retains its reading so that it may be examined after the speed indicator has been removed from the shaft, undertest and remains there until released.

Speed indicators are invaluable in obtaining the speed measurements of equipment difficult of access, in poor light, or wherever it is not possible or practical to keep the eye fixed on the indicator hand.

Since little power is required, speed indicators may be applied to the most delicate and sensitive machinery. In use, the watch movement in the speed indicator engages a pointer when the thumb presses a button and automatically releases it at the expiration of three or six seconds. These speed indicators may be used for either right or left-hand rotation.

For higher speeds ranging as high as 100,000 rpm, there has been developed a Velox Indicator. This is especially useful for high-speed motors, steam turbines, blinding spindles and other high speed equipment. It operates on the same principle as the speed indicator referred to above.

Velox indicators will give the

speed up to 100,000 rpm and have a spindle especially designed with ball-bearings so that a number of tests may be made consecutively without overheating the instrument.

Another type of speed measuring instrument is the cutmeter which is graduated to read directly in feet per minute. It is equipped with an 8 in. circumference measuring disc and with a detachable handle for safe and convenient operation. Again, there is no computing, timing or stop watch necessary. The pointer immediately shows speed and speed variations on the surface of the work. Cutmeters are widely used for determining and maintaining the correct speeds of high speed steel or tungsten carbide tools, paper machines and any equipment, in fact, in which it may be necessary to detect belt slippage. The instrument is also used as a tachometer reading in revolutions per minute.

For permanent control of revolutions per minute stationary tachometers may be installed. These are designed for permanent attachment to equipment in order to give a constant reading. Stationary tachometers are generally specially made with each tachometer being separately calibrated and the scale worked out for definite applications. These stationary-type tachometers are used where it is impractical to go from shaft to shaft and from machine to machine applying a hand tachometer and where the slowing down or speeding up of one unit in a battery of 20 or more may affect the uniformity of a product or operating costs.

The hand tachograph is another instrument designed to maintain the control of speed. It is used by research engineers in many plants for recording the speed fluctuations of revolving units such as turbines, elevators, engines, motors and other machinery.

In use, the instrument is applied to the shaft and the revolution range is recorded on a moving paper strip. Its advantages over the ordinary hand tachometer lies in the fact that a continuous record over any desired periods of revolutions and variations may be kept for future study and for comparisons. The time units are marked horizontally in the revolution rate and vertically on the moving paper strip which results in a chart that may be used time and again.

Research and experiment have taught engineers the speeds at which their products achieve the greatest uniformity, but there is no guarantee that the equipment is consistently running at the desired speed. For that reason, every plant engineer should investigate the potential usefulness and cost-saving possibilities of the hand tachograph.

Photo: George Scherr Co., Inc.

Fig. 2. The tachometer is one of best-known speed measuring instruments. Speed range on this instrument is changed by means of the knurled knob. Position shown in the photo indicates speed of movement from 250 to 3000 rpm

Next comes the hand tachoscope—a tachometer and stop-watch combined in one instrument and used in many plants and laboratories where a very high degree of accuracy is required. A tachoscope is used for tests up to 30,000 rpm and is complete with accessories of various types.

The tachoscope has been found indispensable for laboratory work. Users and makers of textile machinery, electric motors, aircraft engines and other high speed machinery use it for taking readings of machines running at constant rates of speed. This is an extremely accurate instrument since the tachometer is synchronized with a chronometer or stop-watch and each instrument starts to record the instant the trigger is pressed forward by the thumb of the hand holding the tachoscope.

As with most speed measuring instruments, the tachoscope is inserted by hand in the end of the shaft in a directly parallel position. It is so very accurate because the tachoscope cannot start counting revolutions, even when in contact with fast running spindles, until the trigger is deliberately pushed forward and because it engages both revolution and stop-watch counter instantly. After the result has been reached, the two instruments stop simultaneously at a second pressure, giving extremely dependable readings.

There are many uses for the tachoscope among which are testing the speed of spinning looms, spindles, the rate of cutting tests of machine tools, checking the accuracy of other tachometers.

An instrument designed for a slightly different purpose, but one which also measures speed is the vibration counter which has been developed for the purpose of registering transmission line vibrations. This is applied to cables and wires to show vibrations and will count and show as many as 100 vibrations per second. They are designed to register only vertical vibrations having an amplitude of not less than 3/100ths of an inch, but of any frequency between 3 and 100 per second. For observation at infrequent intervals, once every couple of months, there is a model that registers up to 100 million vibrations and another for "on the spot" observation which registers up to 10,000 vibrations and then repeats. The latter may be read in increments of single vibrations.

YOU CAN probably think of several other more conventional uses for chipped ice than in the building industry.

However, a very clever way of making lightweight concrete blocks is by adding chipped ice to the mixture. When the ice melts, the resulting small holes contribute to reduced weight.

Pertinent Points to Consider in ROLLER CHAIN APPLICATIONS

When the purpose of a roller chain is not wholly to transmit power from one shaft to another nor to lift weights it is generally necessary to change the dimensions of parts to adapt the chain to the functions required the author tells the ASME . . . Most failures result from improper modification by the purchaser . . . Characteristics are built into the chain . . . Change these and you probably are in for trouble

By **JOSEPH JOY**
Manager, Engineering Sales
General Chain & Belt Co.

THE SELECTION of roller chain drives for power transmission service is a relatively simple matter. All that is necessary is to follow instructions in the chain makers' catalogs and handbooks. For other uses of roller chain, such as in materials handling, it is necessary to adapt roller chains to the functions required. The general principles utilized in adapting roller chain to such applications must conform to the characteristics of the chain itself.

Roller chain is used quite extensively for oven work where the temperature may go as high as 500 to 600 F. Temperatures of 200 to 250 F do not seriously affect the chain but 500 F will reduce the hardness of the wearing parts. To obtain satisfactory life chains operating in these higher temperatures should be designed to carry considerably less than normal bearing pressure to offset the eventual lowered hardness of the wearing surfaces. Good lubrication is essential and lubricants for high temperature work are available. It is wise to get expert advice on the matter of chain lubrication at high temperature because it has an important influence on chain life.

In common with other forms of power transmission equipment, roller chains begin to wear as soon as they are put into service. But, if they are properly selected and correctly lubricated this wear will occur at an extremely low rate. Wear of the chain results in pitch increase. The pitch of a standard roller chain is measured from the center of adjacent pins. A roller chain has about reached the end of its useful life when the pitch has increased an average of approximately 3½ per cent. When timing or exact spacing is involved permissible pitch extension is much less than 3½ per cent; if the pitch increases only a small amount the timing may be seriously affected. Inasmuch as the rate of wear is inversely proportional to the bearing area the pitch elongation can be held to a rate suitable for ordinary timing applications by providing adequate bearing area in the pin-bushing joints and by using sprockets with comparatively large numbers of teeth.

There are thousands of roller chains in daily use on packaging, wrapping and filling machines where fairly close timing is required. These chains run for many years before replacement is needed. When no measurable deviation from timing exactness is permissible the positioning of articles being conveyed to work stations, as in automatic machinery, is handled by positioning mechanisms which are a part of the machine rather than a part of the chain.

When roller chain is applied to materials handling two chains are often run in parallel some distance apart with cross slats attached to the chains to form a conveyor; this is often done when the conveyor is to carry packages for which no close timing of delivery is involved. On the other hand it may be necessary to convey an article upon which one or more operations is to be performed as in the case of bread wrapping operations or the filling of bottles or cans. In such cases it is necessary to deliver the article to a given point at the right time. In applications of this type the chain must have attachments or modifications of some kind.

In the event that attachment is a block to be fitted to the side of the chain on extended pins, instead of being plate material which can be fabricated and assembled by the chain maker, it is unwise to remove the outer link plate and replace it with the special part. This should not be attempted unless the press fit can be duplicated and the attachment has the same tensile strength as that of the outer link plate. The pin link plates are tension members, securely held in position by press fits, and it is more difficult to duplicate the original conditions than is generally supposed, particularly if the attachment is a bronze casting.

Press fits used with attachment are often lighter and vary widely. Consequently, many attachments eventually work loose. Although press fit of the attachment on the pin is necessary it need be only enough to withstand the load imposed by one attachment instead of the load carried by the link plate. The accuracy obtained by careful drilling and reaming usually provides a sufficiently good fit. If the design permits it the pins can be left projecting beyond the outer face of the attachment far enough to put on a separate press-fit outer link plate.

Figure 1 shows an actual case of poor adaptation. The outer link plate was removed and a steel block was substituted. The pins were home-made and unhardened. The diameter of the extended portion was less than that of the pin proper because this diameter had been reduced to provide a shoulder against which the block could fit and maintain clearance for the roller link. Not only was the cross-sectional area of the pin reduced and, consequently, the strength but the pins were also made of a soft material which still further reduced their resistance to breaking.

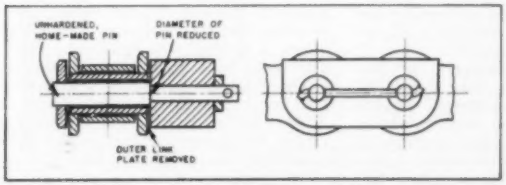


Fig. 1. A poorly executed job of chain modification. Characteristics have been almost entirely changed by additions

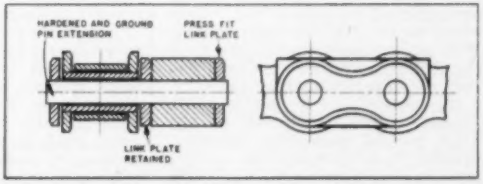


Fig. 2. This is much better. Full strength of the roller chain has been retained and the entire design is much simpler

Figure 2 shows a better and more simple design which should prove satisfactory. In this design the block is fitted to hardened and ground pin extensions which are the same diameter as the pin itself. This eliminates the making of inferior pins by the customer and the necessity for taking the chain apart at the attachment points. The block need be only a light press fit; the press fit link plate on the outside of the block will retain position and give added security. If a uniform light press fit is not possible, or if it is undesirable, the block can be made a snug sliding fit with set screws fitted at one or both of the pins to obtain rigidity. If set screws are used, the outer press fit link plate, although desirable, is optional. The link plates are inexpensive and easily fitted.

Most adapted chains must be supported between driver and driven sprockets and require a track of some kind. For short distances, light loads and slow speeds the edges of the link plates may be allowed to rest on the flat surface of a support. For long runs, heavy loads and moderate speeds a chain with standard diameter roller may be supported under the roller on a track slightly narrower in width than that of the roller. In the case of an extended pitch chain the roller may be oversize in diameter, running on a flat track. The linear speed of the chain may influence the type of chain selected. If support at the roller seems desirable and a standard pitch chain is being considered the speed of the roller should be checked before final decision is made.

In spite of the fact that the bore of the roller and the outside diameter of the bushing are quite hard, a high roller speed requires good lubrication at these bearing surfaces particularly if the chain is heavily loaded. If the speed be higher than that considered good practice, the alternative would be an oversized roller to bring the speed down. This, in turn, means going to an extended pitch chain, a chain with the same bearing area and breaking strength as originally considered but with double the pitch.

Industrial Plant Water Services

2. Calculating Hot Water Pipe Sizes and Capacities

Two methods of computing demand load . . . Pipe sizing for three types of systems, up-feed, down-feed and combination of both . . . Valving for ease of maintenace . . . Example shows how to apply table for computing demand

By **ROBERT K. COLLIER**, Mechanical Engineer

AS WITH COLD water systems, hot water supply piping can be either up-feed or down-feed. However, in addition to the usual risers, a circulating pipe is also used as shown by Fig. 1. This pipe allows water to return to the heater continuously, thereby providing hot water at each fixture whenever it is needed. Besides provision for circulation, venting of the hot water system is also necessary. Either an automatic float type air vent or special arrangement of the piping can be used to remove air from the system. The latter method is generally preferred in small systems because it is cheaper.

Thus, in Fig. 1A, the circulation pipe is connected to the riser below the top fixture. Any air which enters the system will accumulate at the top of the riser and will be relieved when the highest fixture is used. This accounts for the sputtering sometimes encountered in top floor fixtures. In Fig. 1B, a similar arrangement provides for what might be termed automatic venting. With an overhead supply main as in Fig. 1C, either an air vent or a fixture vent can be used as shown.

Hot water used by building occupants can be computed in two ways; 1—from the number of fixtures installed, and 2—from the number of occupants in the building. Table I gives sufficient data for both types of computations. Although each method gives reliable results, demand loads based on the number of fixtures are used more often because it is easier to count the exact number of fixtures than to accurately estimate the number of people in the building. Hence, the illustrative example to be given will use the fixture method of estimating demand load.

Hot water piping

Sizes of hot water pipes are determined in the same way as shown for cold water piping in Part I of this article.* It is usual practice to make the hot water return pipe ¾ in. for small and moderate size industrial buildings and 1 in. or larger where return runs are long. Special calculations are necessary for large systems; they will not be given here because they are not often used. To control circulation flow rate, a globe valve should be installed in the hot water return pipe. Then, if necessary, circulation rate can be increased during periods of extremely cold weather and reduced during hot weather.

To permit maintenance of hot water systems, each riser should be valved near the bottom. Return lines are also fitted with a check valve near the bottom to prevent reversal of water flow when a fixture is in use. These valves increase pressure losses in the piping but the operating flexibility obtained makes them worthwhile. It is good practice to keep branch pipes as short as possible because heat losses are reduced and less water must be run from the fixture before the desired temperature is obtained.

Storage capacity necessary is based on the total demand during the day, the maximum demand during any one hour, and peak load duration. Industrial plants usually require more storage capacity than other types of buildings because duration of the peak load is shorter. Only about 75 per cent of the water in a storage tank can be drawn off at the proper temperature. The remaining water cannot ordinarily be used because it is cooled below the proper temperature by the incoming makeup water. Required storage tank capacity is usually computed when estimating demand load.

Since steam heating boilers are often used to raise the temperature of water, the added load caused by the hot water heater must be computed. In general, to heat one gallon of water per hour through a 100 F range, a quantity of heat equal to that used by 4 sq ft of equivalent direct radiation has to be supplied. This figure is conservative, and includes an allowance for various losses which are encountered in usual systems.

* Part 1, on cold water pipe sizing and capacities, appeared in the March issue, page 58.

Table I. For basing water demand on fixtures and building occupancy

Type Building	Fixture Demand, gph per fixture at 140 F					
	Lavatories	Showers	Slop Sink	Dishwasher	Demand Factor	Storage Capacity Factor
Industrial	12	225	20	20 to 100	0.40	1.00
Office	6	—	15	—	0.30	2.00
Hospital	6	75	20	50 to 150	0.25	0.60
Hotel	8	75	30	50 to 200	0.25	0.80

Demand Based on Building Occupants	Gal per day per person
Industrial	5
Office	2
Hotel	40

Example: Determine the hot water demand for an industrial plant fitted with 10 lavatories, 6 showers, and 5 slop sinks. What capacity heater and storage tank is required?

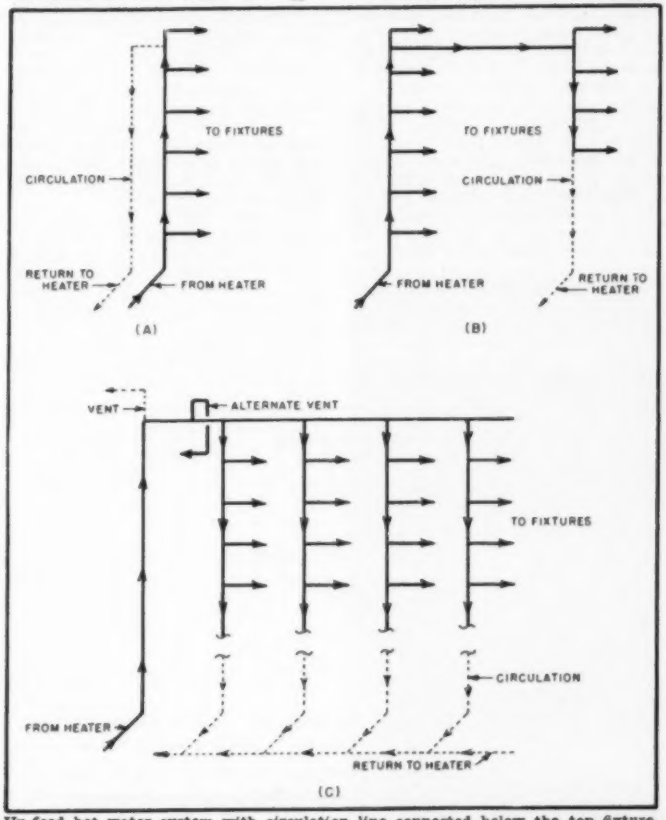
Solution: Using demand figures from Table I,

10 lavatories at 12 gph = 120 gph
6 showers at 225 gph = 1350 gph
5 slop sinks at 20 gph = 100 gph

Possible demand load = 1570 gph

This is the maximum possible demand which might be made on the system. However, experience shows that the maximum demand is seldom encountered in usual systems. A demand factor is therefore used, being in this case 40 per cent, as shown in Table I. Hence,

Probable max. demand = 1570(0.40) = 628 gph
Heater capacity = 628 gph
Storage tank cap. = 628(1.00) = 628 gph



Up-feed hot water system with circulation line connected below the top fixture shown at A. At B, combined up-feed and down-feed system with circulation pipe connected to the heel of the down-feed riser. Sketch C shows down-feed system, circulation and vent piping. Automatic or fixture vent can be used

Note that the heater must be able to increase the temperature of 628 gph from that at supply to the usual 140 F used in industrial plants. Also, the storage capacity must be a minimum of 628 gal. Equality of these two figures results from a unity value of the storage capacity factor. In an office building, for instance, storage capacity would have to be twice as great as the probable maximum demand because the capacity factor is 2.0.

Where water for process use is taken off the hot water supply risers the quantity used per unit time should be added to that required by fixtures in the building. Then the supply pipes are sized by making the same assumptions as in Part I of this article.

Plant engineers who must design, or check water system designs, can readily do so by using the data in these articles. Complete analysis of water services for a building requires, of course, more extensive calculations than those shown here. However, each calculation is simply a repetition of one or more of those given in the illustrative examples. Plant engineers usually have a good conception of what they want from a water system and when they "figure" it themselves, performance is usually close to that desired.

Electrical Breakdowns

(Continued from page 49)

current of the machine, if of the open type marked for a temperature rise not exceeding 40 C. For all other types of motors the relay should be rated at not more than 15 per cent in excess of the full load current.

Ordinary fuses at best are poor over-load protection for motors or generators. It is impractical to use a fuse rated at less than three times the rated full-load current of any motor because of the heavy starting currents. On polyphase a-c motors, ordinary fuses are especially poor protection. This is due to the possibility of single phase operation if only one fuse should blow. Special fuses are available, however, that will afford both over-load and short circuit protection when properly applied.

Summing up, good care and operation consist in keeping windings clean, dry, and free of oil; making sure that all coil wedges and banding wires are tight; that commutator and collector rings are kept clean, smooth and concentric; and that bearings are kept properly lubricated. And where motors are coupled to their loads, proper alignment should be maintained.

If these few requirements are followed carefully, and the motor and its control equipment operated within the limits stamped on their nameplates, trouble and failures will be held to a minimum.

Check Tools, Techniques
In Finishing Sprayed Metals

Structure of sprayed metals and particle hardness effects tooling and finishing methods . . . Tool grinding and methods of machining . . . Wet grinding and dry grinding . . . Finishing flat surfaces . . . Advantages of sealing sprayed metals . . . Spraying techniques and finishing

By JOHN E. WAKEFIELD

METALS SPRAYED with a metallizing gun are entirely different from any other forms of metal. For that reason, attempts to finish them with standard tools or ordinary grinding wheels are not altogether satisfactory. Standard tools and settings tend to pick out particles of the sprayed metal, and leave a ragged looking surface. Ordinary grinding wheels "load" too rapidly, and leave chatter marks and burns on the surface.

The study of structure and particle hardness has led to several conclusions about sprayed metals, which have been borne out in actual service. First, because of the high particle hardness and the oxide content, these metals will wear the nose of tools much faster than other metals do. Second, the tendency for particles to pick out is an important factor, which can be overcome by setting tools slightly above center, producing a burnishing as well as a cutting action. Third, higher speeds help to eliminate "pick-up" of particles, and produce better finishes.

It's quite obvious that cemented carbide tool bits are much more practical than ordinary tools. They resist abrasion longer and they can be used satisfactorily at much higher speeds. They will also finish machine metals like 0.80 carbon steel and medium-chrome, medium-carbon stainless steel which are much too hard in the sprayed state for high speed tools.

Carbide Tools—Carbide has a very low coefficient of friction and high resistance to "welding." Therefore, it will cut freely with less rake and clearance than ordinary tools. Figure 1 shows the various angles which have been found most satisfactory for finishing sprayed metals. It is seldom that it is necessary to take a cut more than 0.025 in. deep. Hence, side cutting angle is of little or no importance. The work is done on the radius of the nose of the tool.

High Speed Tools—Figure 2 shows the desirable angles at which high speed tools should be ground for best results. Note that all three tools recommended are ground for use in a holder which gives a 15 deg back-rake. This eliminates the necessity of grinding the back-rake on the tool itself. Note also that the front clearance is kept to a minimum. This is desirable in the finish cut.

Machining — The usual procedure in machining sprayed metal is to cut to within 0.010 in. to 0.015 in. of the desired finished size on the first cut. The balance is taken in the finish cut, making allowance for filing, emery cloth polishing and so on. If finish grinding is preferred, the finish cut is, of course, eliminated.

It is a good idea, in machining sprayed metal, to set the tool a little above center to produce the burnishing action previously mentioned. This tends to make the metal more dense, and produces a much better finish, as a rule. Here again, it is much easier to accomplish this with a carbide tool. Bronze, Monel and nickel particularly need some pressure from the tool nose for the most satisfactory finish.

An easy way to determine the proper setting of the tool above center is to use a pocket scale. Before the work is rotated, the tool can be run in to the shaft with the scale between the nose and the shaft. If the scale tilts over the shaft a little, the tool is above center about where it ought to be for finishing sprayed metal. If the scale is straight up,

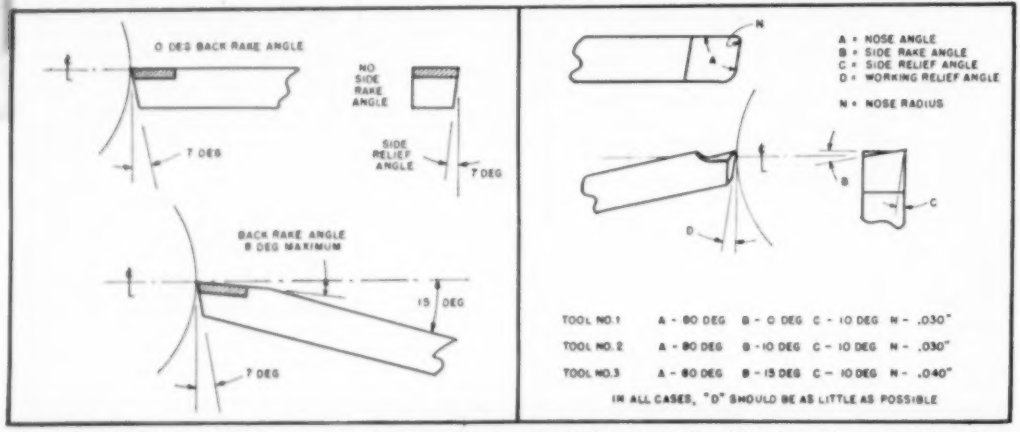

0 DEG BACK RAKE ANGLE
NO SIDE RAKE ANGLE
7 DEG
SIDE RELIEF ANGLE
7 DEG
BACK RAKE ANGLE 0 DEG MAXIMUM
15 DEG
7 DEG
N
A
B
C
D
A = NOSE ANGLE
B = SIDE RAKE ANGLE
C = SIDE RELIEF ANGLE
D = WORKING RELIEF ANGLE
N = NOSE RADIUS
TOOL NO. 1 A - 80 DEG B - 0 DEG C - 10 DEG N - .030"
TOOL NO. 2 A - 80 DEG B - 10 DEG C - 10 DEG N - .030"
TOOL NO. 3 A - 80 DEG B - 15 DEG C - 10 DEG N - .040"
IN ALL CASES, "D" SHOULD BE AS LITTLE AS POSSIBLE

Fig. 1. Left: Angles which have been found most satisfactory in finishing sprayed metals when using cemented carbide tools. Fig. 2. Desirable angles at which speed tools should be ground for best results. All tools shown here are being ground for use in a holder which gives a 15 deg back-rake to eliminate necessity of grinding back-rake on tool itself

Table I. Chart of recommended tools, speeds, feeds for machining sprayed metals

Metal	Tool No. See Fig. 2	Speed—Surface Ft. Per Min.	Feed—Inches Per Revolution
Babbitt			
Aluminum**	3	150-200	0.003 to 0.005
(Government genuine; 97% tin, 3% copper)	3	150-250	0.005 to 0.007
Brass (Yellow Brass)*	2	100-125	0.003 to 0.005
Bronze (Aluminum Bronze)	1	100-125	0.003 to 0.005
Bronze (Commercial Bronze)*	3	100-125	0.003 to 0.005
Bronze (Manganese Bronze)	1	100-125	0.003 to 0.005
Bronze (Phosphor Bronze)	1	100-125	0.003 to 0.005
Bronze (Tobin Bronze)	1	100-125	0.003 to 0.005
Monel	3	100-125	0.003 to 0.005
Nickel	3	100-125	0.003 to 0.005
Copper**	3	100-125	0.003 to 0.005
Iron***	3	75-100	0.003 to 0.005
Lead	3	150-250	0.005 to 0.010
18-8 Stainless	3	100-125	0.003 to 0.005
High-Chrome, High-Carbon Stainless	Grind		
0.10% Carbon Steel***	3	75-100	0.003 to 0.005
0.25% Carbon Steel***	2	50- 75	0.003 to 0.005
0.80% Carbon Steel	Grind		
Tin	3	150-250	0.005 to 0.007
Zinc	3	150-250	0.005 to 0.007

*To improve greatly the machine finish on commercial bronze and yellow brass, apply liberal coat of mixture of one part cylinder oil plus one part kerosene to the sprayed metal, with a brush, and allow to stand for 20 to 30 minutes before machining.
**The same treatment applied to copper and aluminum will give a slight improvement to machine finish.
***The same treatment applied to iron, 0.10% carbon, 0.25% carbon, will not improve the machine finish but will help greatly in preventing the tool from burning and permit higher machining speeds. The treatment is especially helpful in machining any hard sections that may be encountered at the ends of the sprayed section or in corners.
NOTE 1—Do not use this treatment* on 18-8 stainless, nickel, Monel, aluminum bronze, and phosphor bronze, since to do so will result in a poor instead of an improved machine finish.
NOTE 2—Excellent finishes have been obtained on sprayed Monel using condensed milk as a cutting fluid.

the tool is on center and should be raised a trifle.

For rough machining with high speed tools, speed, depth of cut and so on are not particularly critical. However, the speeds and feeds shown in Table I can be used in roughing as well as finish cuts. With carbide tools the speeds and feeds in Table II are recommended.

Shoulders—In metallizing shafts, such as those shown in Fig. 3, there is almost always a ridge of sprayed metal at one or both ends of the sprayed section. The center shaft in the photograph is typical. Such ridges should always be machined down close to finish size before any other machining is done. A blunt-nosed tool should be used for this purpose, and cuts should always be taken from the sprayed area out toward the bare shaft. This is shown in Fig. 4. The reason for cutting "from the inside out" is that the sprayed metal is not bonded to the shaft outside the prepared area ending at the shoulders. If the tool were run into the unbonded sprayed metal first, its tremendous leverage might break the sprayed metal away from the shoulder and leave a ragged joint.

When grinding is done instead of machining, the shoulders should be ground down first. Here, it is more a question of saving the wheel, since there is little danger of breaking away the coating with a grinding wheel.

Grinding—It has already been pointed out that sprayed metals tend to "load" wheels faster than ordinary metals do. For that reason, a wheel of fairly coarse grain and low bond strength is recommended. Such wheels produce much better finishes and do not have to be redressed so often.

Wet grinding is preferable to dry grinding, although wheels are now available for tool-post type grinders. They produce a quite satisfactory finish if used as recommended as to type and speeds.

Flat Surfaces—Finishing flat surfaces of sprayed metal presents certain problems. Here, grinding is certainly preferable, although the materials can be finished in planers or shapers. Where a planer is used, or a shaper, all raised sections, corresponding to the raised shoulders on shafts, should be removed first by filing or grinding. Thin, light cuts should be taken in order to exert a minimum of leverage on the bond between the sprayed metal and the base.

Milling cutters, rotating opposite to the work feed or traverse cuts in an upward direction, place far too much strain on the bond. This can cause lifting of the coating particularly along the edges of keyways. If it is necessary to re-mill a keyway, it is good practice to file or grind the edges of the sprayed metal back before milling. Again, very light cuts should be taken.

Sealing—In some applications of metallizing, it is advisable to seal the coating to prevent penetration of acid or even high pressure water through to the base. For example, a hydraulic press ram coated with stainless steel should be sealed, and the sealing should always be done before finishing.

Stainless steel, Monel, nickel, etc. can be sealed effectively with tung or linseed oil. Raw tung oil and either raw or boiled linseed oil mixed with 5 per cent by volume of cobalt liquid drier work quite

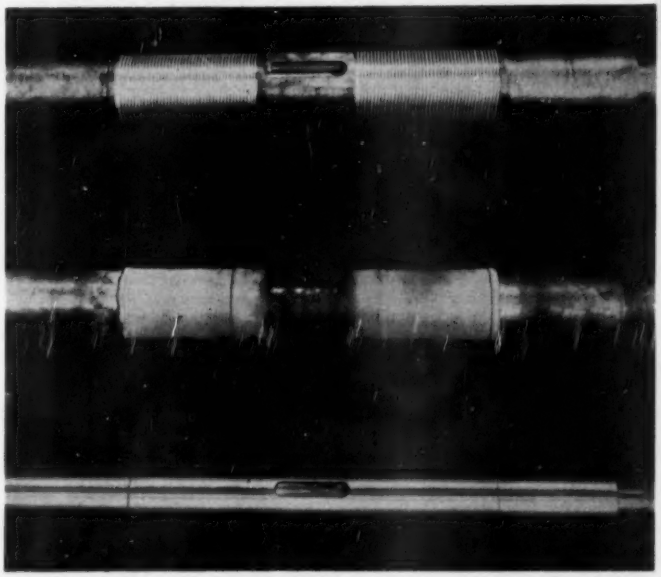


Fig. 3. Note the ridges of sprayed metal at ends of newly sprayed surface of center shaft. Machine these close to finish size before other machining is done

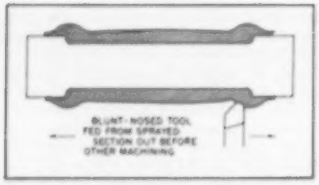


Fig. 4. To machine down shafts such as those shown in Fig. 3, cuts should always be taken from the sprayed area out toward the bare, unsprayed shaft

well. Parts should be painted or dipped while still warm after spraying. They should not be hot. Coatings must be thoroughly saturated. It is better to allow a part to dry for at least two days after treating in this way, before finishing. The surface will be duller in appearance, but will be entirely satisfactory as a bearing or packing surface.

Another very satisfactory method of sealing is to dip the part in molten Acrowax C at 310 to 350 F. This treatment should also be given before finishing. Parts should be allowed to soak in the Acrowax C until the coating is completely filled. An hour or so of soaking is desirable, but this depends somewhat on the thickness of the sprayed coating. The main thing is to have the wax thoroughly penetrate and saturate the coating.

One other thing which can affect finishing of sprayed metals, particularly the steels, is the technique of spraying them. The three principal factors are: 1. the ratio of oxygen to acetylene in the metallizing flame; 2. the distance of the gun from the work; and 3. the distance the melting tip of the wire extends outside the front end of the gun. All three can affect the hardness of sprayed steel appreciably.

Manufacturers of metallizing units give quite specific recommendations for the gas settings on the pressure regulators, and for the two distances noted. They should be followed carefully.

Gas Ratio—To illustrate the effect of different gas ratios on hardness, one gun was set up with 0.10, 0.25 and 0.80 carbon steels, using oxygen and acetylene. The following table shows the Rockwell B scale hardness of the metals with several different oxygen to acytelene ratios:

Metal	2:1	3:1	4:1
0.10 carbon steel	B88	B92	B92.5
0.25 carbon steel	B92	B95.5	B98
0.80 carbon steel	B108.5	B110.5	B108

A 3 to 1 oxygen to acetylene ratio was recommended for this particular metallizing gun. The figures indicate a fairly wide fluctuation in hardness below and above the proper hardness when the ratios were changed from normal either way.

Distance of Gun to Work—The distance of the gun to the work was far less critical and probably would not appreciably affect the finishing of these same metals. Instructions with the gun called for a distance of 5 in. to 6 in.; 0.10 and 0.80 carbon steels softened both when the gun was too close to the work and when it was too far away. Furthermore, when the gun was too far away, the adhesion of the particles of the coating to each other became weaker. But, 0.25 carbon steel was little affected by slight changes in distance. The softening of the materials noted would tend to make machining easier, but would lessen the wear resistance of the metals.

Length of Wire Tip—The recommendation for the distance that the melting tip extended from the front of the gun was approximately ¼ in. Running the wire more slowly, which would have the effect of drawing the tip closer to the gun, had little apparent effect. Running it too fast, which made it extend much more than ¼ in. outside the gun, increased the hardness of all three metals, and 0.10 carbon steel particularly. The increase in hardness of the 0.10 carbon steel was such that machining with ordinary high speed tools was almost impossible.

The effects of improper spraying technique have been mentioned because, if finishing difficulties are encountered, it is a good idea to investigate this aspect of the metallizing operation as well as the tools and speeds used for finishing. All too often, the difficulties are with the metallizing operation and not in the shape or setting of the tool.

The best way to eliminate the possibility of improper operation of the gun and the consequent finishing difficulties, is to use a gas flow meter unit while spraying. This unit controls the flow of gases and permits the oxygen and acetylene to be set at the proper flow ratio. Furthermore, with the unit, exact flame balance can be obtained at any time, without guesswork.

The two distances discussed can be corrected visually, and it is important that manufacturer's recommendations be followed. The length of the melting wire tip is certainly the more important of the two as far as its effect upon machining is concerned.

Table II. Speeds and feeds for machining sprayed metals with carbide tools

Material	Speed (Surface Ft/Mn.)		Feed (In./Rev.)	
	Rough	Finish	Rough	Finish
Yellow Brass	250-300	300-350	0.006"	0.002"
Commercial Bronze	250-300	300-350	0.006"	0.002"
Manganese Bronze	250-300	300-350	0.006"	0.003"
Phosphor Bronze	250-300	300-350	0.006"	0.003"
Tobin Bronze	250-300	300-350	0.006"	0.003"
Copper	250-300	300-350	0.006"	0.003"
Iron	75-100	100-125	0.006"	0.003"
18-8 Stainless	100-125	125-175	0.006"	0.003"
High Chrome, High Carbon Stain	30- 40	30- 40	0.004"	0.003"
Monel	200-250	250-300	0.004"	0.002"
Nickel	200-250	250-300	0.004"	0.002"
0.10% Carbon Steel	75-100	75-100	0.006"	0.003"
0.25% Carbon Steel	50- 75	50- 75	0.004"	0.003"
0.80% Carbon Steel	30- 40	30- 40	0.004"	0.003"

Plant Maintenance and Your Safety Program

Contributed by W. A. Bruce, Pl. Engr. Engineering Research Assoc., Inc.

THE AVERAGE experienced plant maintenance employee is safety conscious, and his knowledge attained by years of remedying safety hazards should be advantageously used in all types of industry, in large plants or small.

This fact is particularly true in the small plant with 150 employees or less, and where the full time employment of a safety engineer or specialist is not practical.

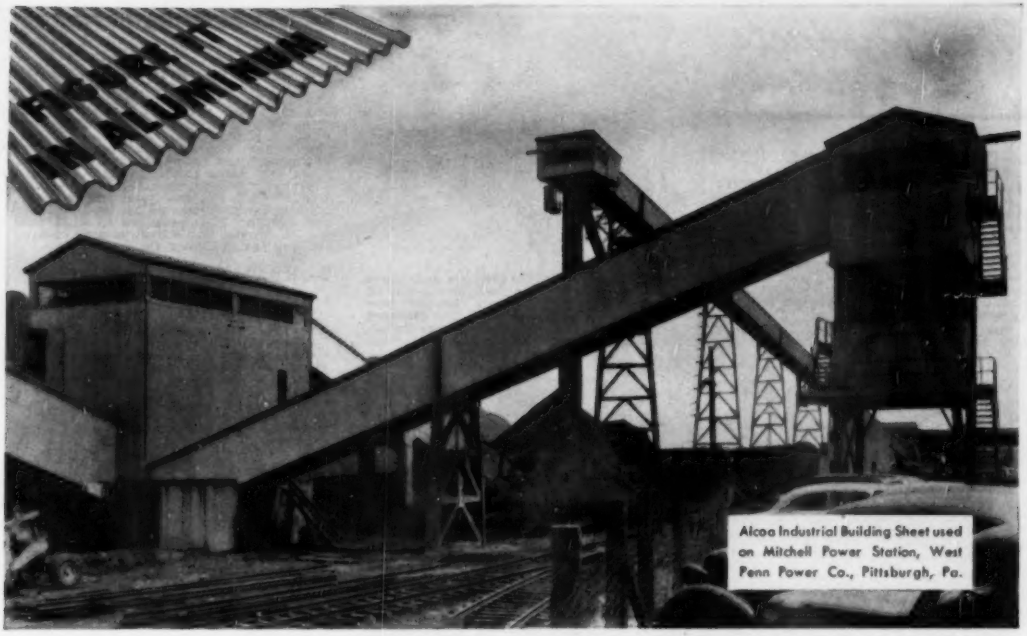
In some instances the entire maintenance staff is charged by management with the responsibility of maintaining a planned and workable safety program, in which event the plant engineer or maintenance supervisor may pass upon and authorize such improvements in procedure and physical protection which from time to time are called to his attention.

As the maintenance force usually carries out the orders involved it naturally follows that the method of performance of accident preventive measures can be and often is improved upon by them at the time the work is accomplished.

The average maintenance employee is cost conscious, as well as safety minded, and is a fine liaison between management and production employee when trained to accept responsibility as to plant safety procedures.

Plant management will find this statement especially true where piece work incentives are in effect; in which event there is reluctance to accept many safeguards of benefit to the employee which may slow up an operation.

We will add in support of our remarks that usually a production supervisor is inclined to slight, to some degree, the importance of a safety program—due to his primary effort concerning quantity and quality of his production output.



Alcoa Industrial Building Sheet used on Mitchell Power Station, West Penn Power Co., Pittsburgh, Pa.

FOR PLACES YOU DON'T EVER WANT TO PAINT

Alcoa Industrial Building Sheet gives long life and freedom from maintenance

Faced with the problem of selecting roofing and siding that would stand up in corrosive atmospheres; require a minimum of maintenance . . . West Penn Power Co. specified Alcoa Aluminum Building Sheet . . . used it to cover conveyors, machinery sheds and utility buildings. "Resistance to corrosive coal dust and freedom from painting", dictated the choice according to the owners.

Easy to put up in hard-to-get-at places, Alcoa Industrial Building Sheet weighs only 56 lbs. per hundred square feet, can be erected quickly over steel or wood by all standard fastening methods. Low in first cost, it keeps maintenance costs down, too. Keeps its good appearance; resists corrosive effects of industrial smoke and fumes.

For data on application, prices and accessories, call your nearby Alcoa Sales Office, or mail the coupon at the right.

FACTS FOR BUILDING OWNERS AND MANAGERS

***Low Cost*— Alcoa Industrial Building Sheet is low in first cost. Keeps upkeep costs down, too. Can't rust away. Needs no painting.**

***Tough and Strong*— 25 years on coal tipples, hasn't affected the serviceability of Alcoa Building Sheet. With 4' purlin spacing it will support 80 p.s.f. uniform load (safety factor: 2).**

***Available*— Prompt delivery from convenient suppliers. All types of fasteners and flashing accessories in stock.**

For complete details MAIL THIS COUPON, TODAY

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Please send me engineering and application data on Alcoa Industrial Building Sheet.

Name _____

Company _____

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ALCOA INDUSTRIAL BUILDING SHEET

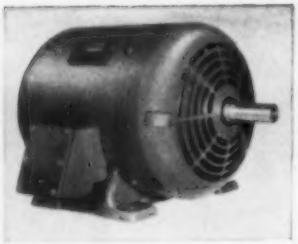
ALCOA ALUMINUM

INGOT • SHEET & PLATE • SHAPES, ROLLED & EXTRUDED • WIRE • ROD • BAR • TUBING • PIPE • SAND, DIE & PERMANENT MOLD CASTINGS • FORGINGS • IMPACT EXTRUSIONS
ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS

New Products and Methods

1—CHEMICAL MOTORS

For application where corrosive fumes, liquids are encountered



Frames, brackets, hoods and other exposed parts of these motors are alkali-cleaned, hot water rinsed in chromic acid spray, then dried and sprayed with phenolic-alkyd type enamel and baked, manufacturer states, and additional protection is provided by a coat of gray enamel and several dips of thermoset varnish followed by a coat of gray lacquer.

The motors use bronze split-hub, clamp type blowers. Rotating neoprene slingers on shafts between rear brackets and hoods are used to keep dirt and liquids out of bearing housings. Factory sealed, pre-lubricated bearings are used. The gasketed conduit box can be rotated to meet installation needs. Westinghouse Electric Corp.

2—SELF-FORMING PACKING

Comes in rope form ⅛ in. wide, to fit any size and shape

Described as self-lubricating and stringless, Steamfitters Special Packing is designed to form itself into a solid, lead-like, leak-proof seal the exact size and shape of any fitting or pump stuffing box into which it is placed. It is expected to give long service, and is recommended for use on rotating and reciprocating rods, shafts, stems and joints handling air, gas, water, steam (up to 150 psi), oils, most acids, alkalis and solvents, and refrigerants. Manufacturer stresses its use on steam, oil and gasoline. It is packaged in ½ lb and 2½ lb spools in self-dispensing boxes. Packing Div., Flexrock Co.

3—HEAT EXCHANGE COILS

For use singly or in multiples to provide closed-type cooling

The Type D Evaporative Heat Exchange Coils are intended to handle a variety of cooling liquids and for such use as cooling diesel and gasoline engine jacket water. Liquid is circulated through heat exchanger in a closed circuit and coils are cooled by the showering action of raw water sprayed over the tube surfaces. Tubes are staggered for maximum surface exposure.

Coils are available alone, or with company's natural or mechanical draft tower. Company claims good temperature performance because spraying process cools raw water in advance of its contact with hot tube surfaces; greater ratios of raw water to liquid being cooled can be used; cooling of coils is by both evaporation and convection; scale formation on tubes is reduced, and a three-pass arrangement in the coils gives increased velocity of liquid through tubes.

Standard tubing is 1 in. No. 21 gage BWG copper, and inside of tubes is accessible from tubing headers, which are cast iron with large fins. Binks Mfg. Co.

4—METAL TREATMENT

For equipment scheduled for water submerged service

Dampney Metal Primer is formulated to inhibit corrosion temporarily prior to finish coating and to bring to surfacing material to be applied over it an improved bonding and great durability. This vinyl formulation is intended for use in combination with company's Apexior No. 3, for service in water-storage tanks, condensers, and wherever metal is exposed to fresh or salt water at temperatures to 140 F.

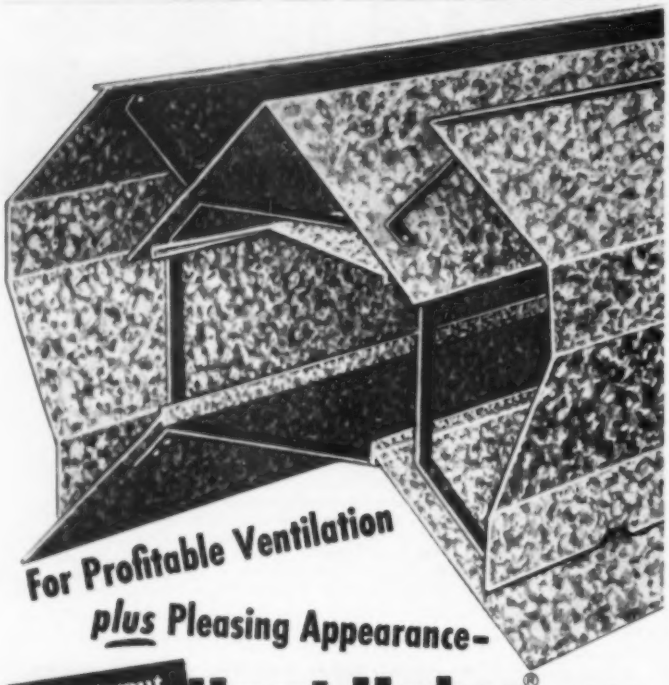
The primer may be applied by brush or spray to any clean metal. Only one coat is required because recommended coverage is less than tissue-paper thickness and 1 gal is intended to protect 800 to 1000 sq ft of surface. Applied film dries ready for finish coat in ½ hr, company states, but if final surfacing is delayed, the film is resistant to sub-freezing temperature, summer heat, high humidity and heavy rain. The Dampney Co. of America.

5—COOLANT SEPARATOR

Is magnetic type for small honing, grinding, threading machines

The No. 00 Barnesdrill Midget Magnetic Coolant Separator has a 1½ gpm capacity. It is small and compact and can be placed in coolant storage tank to remove metal

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 37-38 and 91-92.



Swartwout-Dexter Heat Valve®

THE Original RIDGE VENT

Peak roofs on factory and commercial buildings make ventilation easy if you free the way with low-friction, natural-flow Heat Valve. Large capacity per square foot of opening makes this Swartwout design economical and profitable equipment. Other types, including powered ventilators, fill any need on any type of building.

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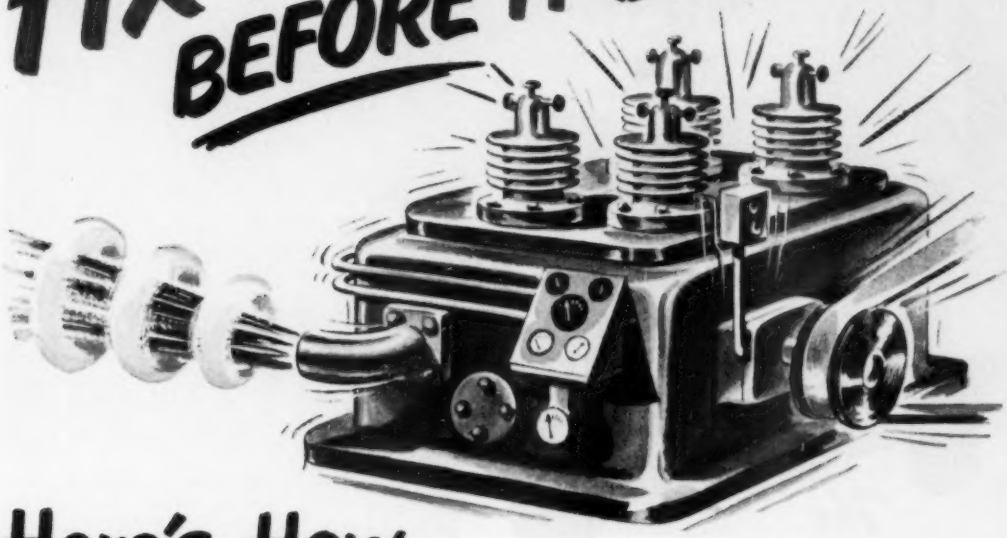
The Swartwout Co.

Industrial Ventilation Specialists Since 1904

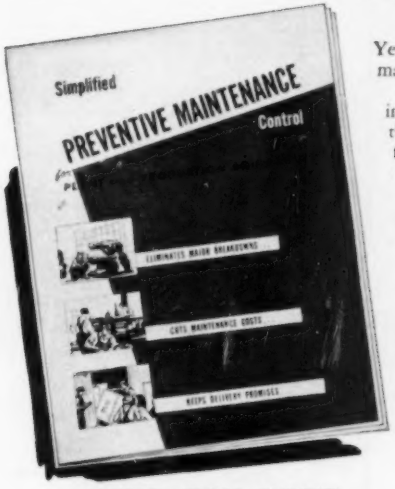
Equipment for Controlled Air Circulation

FIX IT... BEFORE IT BREAKS!



Here's How:

Scheduled Preventive Maintenance Controlled by KARDEX VISIBLE RECORDS!



SEND FOR YOUR FREE COPY TODAY!

Yes, with a Kardex Visible system, you review and *control* your preventive maintenance schedules . . . *at a glance!* Here's how the system works—

Experience and performance are combined to set up a pre-arranged, tested, inspection schedule. Kardex colored signals indicate . . . *automatically* . . . those items due for inspection. A "Floating Inspector's" record is withdrawn from the Kardex pocket, filled-out with instructions specific to the check-up to be performed, and routed to your maintenance men as a work order and report sheet.

When the maintenance job is complete, the maintenance man checks off what he did and the card is returned to its place, *automatically* signaling job completion. Then, the Kardex signals are advanced to the next date specified. Details are posted on the maintenance card from the job card, providing a continuing, *permanent* record of maintenance activity.

The quick result: needless, costly "down-time" is eliminated; operating efficiency goes up; manufacturing costs go down—all accomplished with *less* clerical help and a minimum of time-wasting paperwork, thanks to the "floating" maintenance order!

You'll find valuable information in *SIMPLIFIED PREVENTIVE MAINTENANCE CONTROL*, just published by Remington Rand to help you. Too, you'll learn of the profit-building advantages in controlling plant inventories with Kardex *simplified* property records.

To establish, once and for all, complete control over your maintenance activity and to hold inventories at a healthy, low level, write for your copy *today!* Ask for KD-449, *SIMPLIFIED PREVENTIVE MAINTENANCE CONTROL*. Address: *Management Controls Reference Library*, Room 1146, 315 Fourth Avenue, New York 10.

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LEWIS-SHEPARD
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ONE TON CAPACITY MODEL GC2-56

The "TOTEMASTER"

POWERED BY A 20 H.P., 4 CYLINDER GAS ENGINE

Indoors or out — this rugged ONE-TON Toter scoots around with loads up to capacity and at speeds up to 20 M.P.H.

- Crosley 4 cylinder engine — 20 HP, CI block — 5 main bearings.
- High compression engine — Ratio 7.8:1. More complete combustion means reduced fuel and less fumes.
- Electric starting. No cranking, therefore operator will stop engine while loading truck. Saves fuel and reduces fumes.
- 3 speeds forward — 1 reverse. Saves strain on engine. Increases grade performance with heavy loads. Lowers maintenance cost.
- Two wheel drive — differential. More effective traction. Less wear and tear.
- Water cooled engine — quiet and cooler.
- Hydraulic brakes — airplane type.
- Double handle grip provides one or two hand steering.
- When operator leaves seat, parking brake is mechanically applied.

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The "MASTER" Line

21 Sq. Ft. of Loading Space . . . . Draw Bar Pull: 1200 lbs.
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REPRESENTATIVES IN PRINCIPAL CITIES

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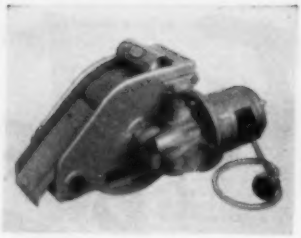


particles and fused abrasive from the work. The constant removal of the "load" provides a uniform coolant supply, company points out, and the clean coolant allows a precision finish faster and free of scratches. This midget model supplements company's line of separators in 5 to 350 gpm capacities. Barnes Drill Co.

6—TORQUE WRENCHES

Are designed for easy use, cover range of 2 to 36,000 in.-lb

Tension breaks automatically with this type of wrench, manufacturer states, when proper torque value is reached to insure accuracy and minimize operator fatigue. These wrenches are recommended for production line, critical maintenance and assembly or inspection operations. Available with micrometer adjustment over operating range, or may be ordered pre-set to any torque value. Wrenches may be re-set at plant to conform with changes in torque specifications. JO Manufacturing Co.

7—REGISTER CONTROLS

Are one-way cut-off type for use on web-feed machines

These controls are designed to automatically cut a web of preprinted material so printed matter appears at right point. They consist of just two panels where five were formerly used to cover same range of application.

According to company, register control is required where a continuous strip of preprinted material is punched, perforated, or cut into predetermined lengths, to maintain proper position of the cut. One-way control is used where low to medium web speeds and medium accuracies are involved.

One panel utilizes a thyratron output tube and is for machines where a cam-operated automatic reset switch determines length of time correction is applied. The other panel, for use where machine timing isn't desirable, utilizes vacuum tube output and has built-in electronic timer. Panels include voltage regulator tubes and have built-in light power source. Control Divs., General Electric Co.

8—KRYPTON-ARGON LAMP

Is engineered to provide more light without higher costs

This 90 w fluorescent lamp can bring 6 per cent more light into a plant without noticeably increasing the electric bill, according to manufacturer. The new tube, containing equal amounts of krypton and argon gases, supersedes company's 85 w, all-krypton lamp. The same size, it operates in either 85 w or 100 w fluorescent lighting equipment.

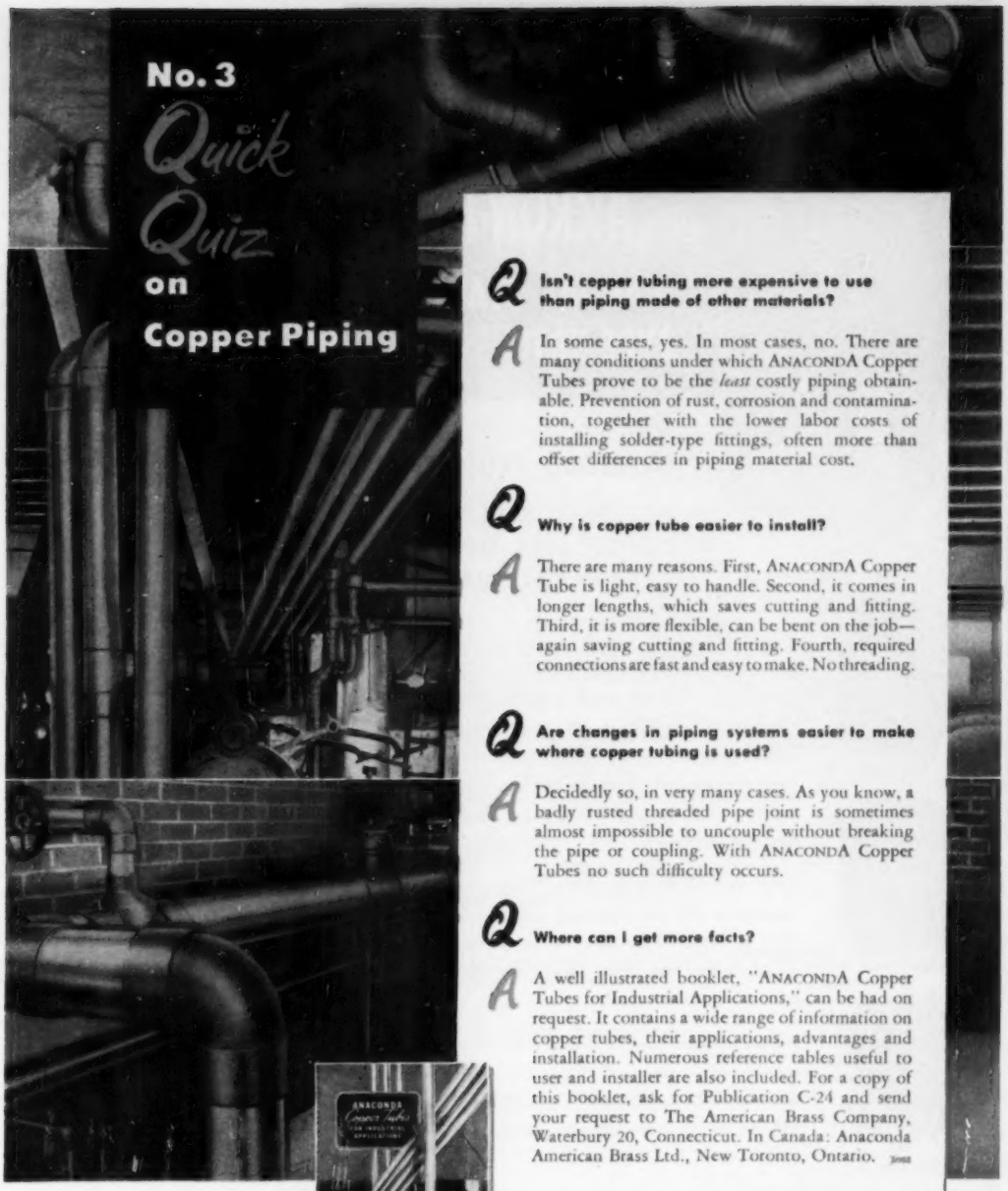
The 50-50 balance of krypton and argon gases is claimed to produce a high power lamp that generates more light than all-krypton lamp and starts easier and operates better in low temperatures. Five-ft long and 2½ in. dia, the 90 w tube is among the largest of fluorescent lamps. Its average life span is given as 7500 hr, or almost 4 yr of burning on a 40-hr week schedule. Lamp Div., Westinghouse Electric Corp.

9—COAL FEEDER

Offers variable speed for close control volumetric feeding

This feeder is intended for conveying coal at controlled rate without pulsation into furnace against both heat and pressure. It handles 35,000 lb of coal per hour from weigh scale to furnace hopper by a chain and circular flight assembly. The unit consists of drive and take-up, receiving section, pneumatrol, water cooling section and idler box.

The pneumatrols enable conveyor cir-



No. 3 Quick Quiz on Copper Piping

Q **Isn't copper tubing more expensive to use than piping made of other materials?**

A In some cases, yes. In most cases, no. There are many conditions under which ANACONDA Copper Tubes prove to be the *least* costly piping obtainable. Prevention of rust, corrosion and contamination, together with the lower labor costs of installing solder-type fittings, often more than offset differences in piping material cost.

Q **Why is copper tube easier to install?**

A There are many reasons. First, ANACONDA Copper Tube is light, easy to handle. Second, it comes in longer lengths, which saves cutting and fitting. Third, it is more flexible, can be bent on the job—again saving cutting and fitting. Fourth, required connections are fast and easy to make. No threading.

Q **Are changes in piping systems easier to make where copper tubing is used?**

A Decidedly so, in very many cases. As you know, a badly rusted threaded pipe joint is sometimes almost impossible to uncouple without breaking the pipe or coupling. With ANACONDA Copper Tubes no such difficulty occurs.

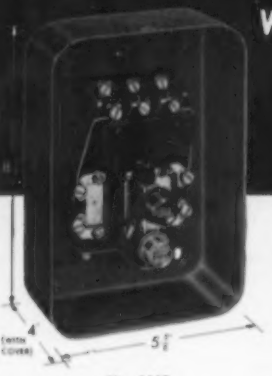
Q **Where can I get more facts?**

A A well illustrated booklet, "ANACONDA Copper Tubes for Industrial Applications," can be had on request. It contains a wide range of information on copper tubes, their applications, advantages and installation. Numerous reference tables useful to user and installer are also included. For a copy of this booklet, ask for Publication C-24 and send your request to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

For better Piping...use **ANACONDA COPPER TUBES**

STOP and START

with ARROW-HART MANUAL STARTERS TYPE "RT"



No. 1393

with

OVERLOAD PROTECTION

DESIGNED FOR DEPENDABLE OPERATION EASY MAINTENANCE

No. 1393

No. 1393-D

No. 1395-W

Simple installation, quick and easy inspection and maintenance are just a few features of the many you'll get in these compact, tough and dependable manual starters. For instance, all components are readily-accessible *from the front;* there's plenty of room in the box for wiring; the unit can be serviced without removing it from the enclosure.

STOP and START is provided by the over-center mechanism. The heart-shaped cam-and-roll principle is activated by torque-type spring to give smooth 2-way operation. Simply push the START button for positive reset.

There's an A-H Type "RT" Manual Starter for every requirement — standard, dustproof, weatherproof and units only. Available in a wide range of phase, voltage and horsepower ratings; up to 7½ H.P.

CONTROLS and APPARATUS FOR *Outstanding* PERFORMANCE

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THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
HARTFORD 6, CONN. U.S.A.

BRANCHES IN: BOSTON, CHICAGO, CLEVELAND, CINCINNATI, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK, PHILADELPHIA, SAN FRANCISCO, SYRACUSE
IN CANADA: ARROW-HART & HEGEMAN (CANADA) LTD., MT. DENNIS, TORONTO

cult to handle coal from an atmospheric pressure zone to a zone above atmospheric, it is explained. Coal is discharged from idler box into the furnace hopper. Air under pressure is introduced into this hopper through ducts and the coal is fed directly into the air stream. Idler box has a vibrating plate feeder made with controls outside the pressure zone and its use is intended to permit even coal flow to boiler, eliminating feed pulsation.

The receiving section is engineered to allow coal to be fed to chain and flight assembly so voids between flights will be uniformly filled even though coal is wet. Both return and carry runs of the chain go through the receiving hopper. Hapman Conveyors, Inc.

10—SAW ATTACHMENT

For electric drills, for cutting wood, transite, pipe, conduit

Intended to cut anything from 10 gage sheet metal to plaster, the Super-Saw has a blower to cool and remove chips and sawdust from cutting line. The tool is a gear-driven reciprocating saw, with special blades for cutting different materials. It is made for use with a heavy-duty, ¼ or ⅜ in. drill, 2000 to 3000 rpm. It can be used on an air drill or flexible shaft, company says, if sufficient power is behind it.

Cuts may be started without boring a hole. Saw has curved guide on lower side. To begin a cut, rest this on surface to be sawed with blade tip positioned over starting place. Drill is started while tool is held tight against surface. When saw is in motion blade tip is brought into contact with the work by tipping tool forward on the guide. As blade cuts through material, saw is brought into upright position, so cutting edge is at right angles to work. RCS Tool Sales Corp.

11—PROTECTIVE COATING

For many surfaces, offers corrosion and oxidation resistance

Although created primarily for use on metals, the sealing power of End-O-Rust is described as adaptable for use on concrete, wood, fibre or any surface where more than normal protection is needed. Tests are said to show great resistance to salt spray, caustic soda, ammonia, sulfuric, acetic and hydrochloric acids, and to weather temperature extremes over long periods.

According to manufacturer, this coating will air dry for handling in 2 to 3 hr., force dry in 30 min and infra red bake in 3 to 5 in., and it has a hard gloss finish, impervious to abrasion, weathering and hard wear. It is especially recommended for areas which must withstand dampness, humidity or salt air. End-O-Rust, Inc.

12—FLASHLIGHT

Is less than 8 in. long and powered by 8 standard batteries

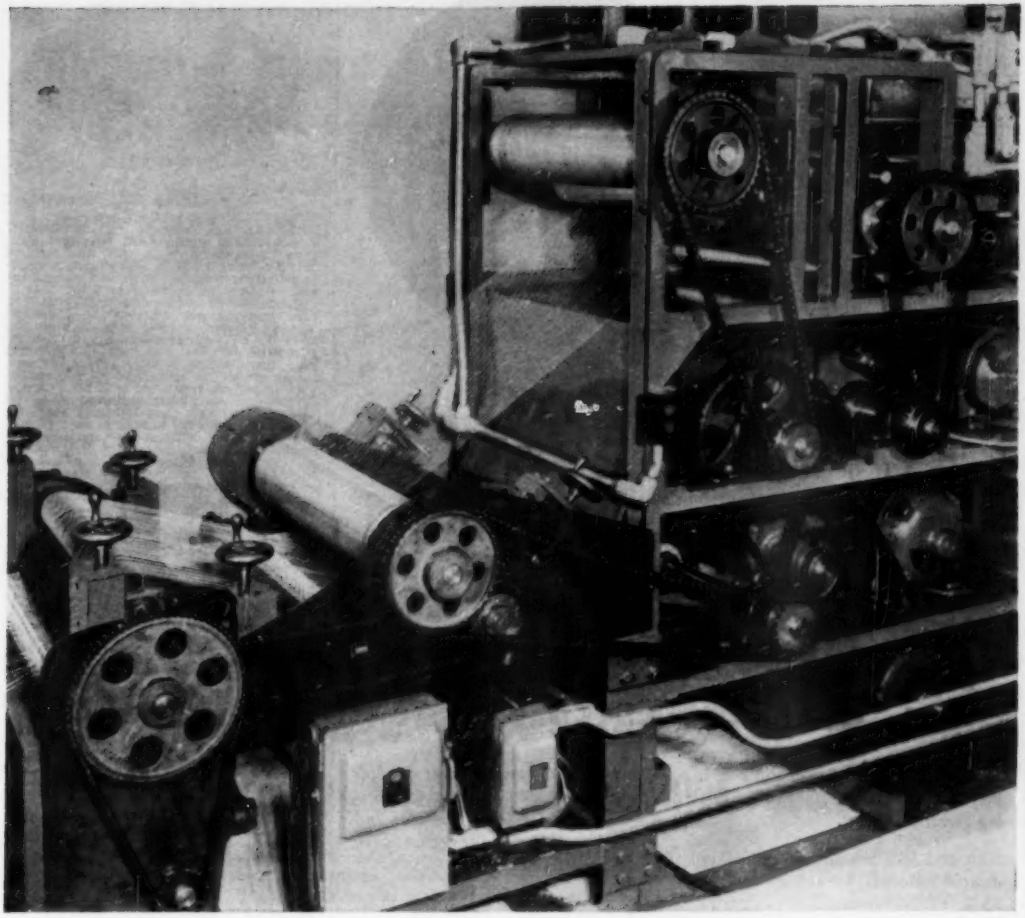
The Yellow-Flash 8, originally offered as a sportsman's light, is described as an extremely powerful flashlight, but is compact enough to fit in a tool box. Its eight batteries deliver a 12 v, 2500-ft beam, company states, and a convertible circuit is provided to permit using a standard 6-v lantern battery with the substitution of a lower power bulb. Prices begin at $3.95. Justrite Mfg. Co.

13—PLASTIC PIPE

Is semi-rigid extruded type with increased range of application

The Carlon "T" Pipe is said to feature high tensile and flexural strength, is light

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 37-38 and 91-92.



Keeping Three Distinct Tension Zones **SYNCHRONIZED!**

Positive Whitney Chain Drives Help Fibre Bonding Machine Get Accuracy and Flexibility of Yarn Tension

The Dan River Mills "Fibre Bonded" process increases tensile strength of textile yarns by impregnating yarns with synthetic resins. This bonding machine, manufactured by Walter Kidde & Co. performs all operations . . . unwinding, impregnation, stretching, curing, and rewinding.

Yarn tension must be varied and strictly controlled for the different phases of the process and for different textiles. During the bonding process, pull is placed on the strands by driving each succeeding roll at a faster rate than the preceding roll.

To keep the three tension zones synchronized, *Walter Kidde & Co. uses an interconnected series of positive drive Whitney Roller chains* from the electric motor to the various rolls.

And for good reason... deeply seated in the sprockets, Whitney Roller chains deliver full power without speed loss or slippage from power sources to driven elements.

Their versatility and adaptability enables shafts to be driven clockwise or counter-clockwise from one power source simultaneously. They operate slack on short or long center: . . . do not impose excess loads on bearings.

Whitney Roller chains absorb shock loads without breakage assuring long life. They simplify maintenance when necessary because they can be put on or taken off without disconnecting shafts or gears.

No matter what power drive problem, Whitney Chains and Cut Tooth Sprockets . . . the all steel drives . . . meet requirements for positive power transmission.

Whitney Chain Drives . . . roller, silent, conveying chains and cut tooth sprockets . . . are quickly available through a nationwide network of Whitney Distributors and Whitney Warehouses. Consult the one nearest you for prompt and efficient service. For Specialized engineering assistance write:

WHITNEY *Power Line* ROLLER CHAIN DRIVES

WHITNEY CHAIN COMPANY

Division of Whitney-Hanson Industries, Inc.

232 HAMILTON STREET, HARTFORD 2, CONN.

How much TOO MUCH do accidents cost you?

Accidents are costly enough. But if they include slips and falls, you're paying *premium prices*.

Slips and falls run about 19% of industrial accidents; yet account for over 23% of compensation payments. That's a 21% "overcharge" on every slip. Expensive accidents.

Much too expensive when it costs so little to establish a program with the Legge System of Safety Floor Maintenance.

It can help you make grease-drenched plant floors slip-resistant for only 35c per square foot; polish administrative floors to a safe, attractive lustre for as little as 16c per square foot per year. And, absolutely free, you can have a Legge Safety Engineer develop a master floor safety maintenance plan: teach your crews safety methods and streamlined techniques that save housekeeping dollars.

This Legge System of Safety Floor Maintenance plan has reduced slippery floor accidents up to 95%; cut insurance costs as much as 42%. And, as a bonus, it has saved up to 69c of every floor maintenance dollar.

You owe it to yourself to explore this proven accident- and cost-cutting method. For full details, clip the coupon to your letterhead and mail. Walter G. Legge Co. Inc., New York 17, N. Y. Branch offices in principal cities.

Walter G. Legge Co. Inc.
101 Park Ave., New York 17, N.Y.
Without obligation, please send me complete details on the Legge System.

Signed _____

Title _____

Types of flooring _____

Area: _____ Sq. ft. PB-5

LEGGE SYSTEM
of Safety Floor Maintenance

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Walter G. Legge Co., Inc., N. Y.

See us at Booth No. 8, Michigan Safety Conference, Detroit, Mich., May 15-18.

in weight. According to manufacturer, it is guaranteed against rot, rust and electrolytic corrosion, and will not form a galvanic couple. It is also said to be undamaged by freezing water and can be installed above or below frost level.

Furnished in random 20 ft lengths, the pipe sections are connected by cement treated plastic sleeves slipped over the ends to be joined. Such sleeves can be furnished for use with established metal pipe installations with standard fittings.

Because of its semi-rigid characteristics this pipe is recommended for suction lines, lawn sprinkling systems, over-land piping, jet well installations, and for handling liquids for human or animal consumption, as well as for transmitting sewage and for processing or exhaust systems handling corrosive fumes, gases or vapors. It is described as a natural insulator and recommended for use as conduit to carry high voltage wiring in electrical installations. Carter Products Corp.

14—GLASS BLOCKS

Are designed for uniform panel appearance, brightness control

Functional features of the seven new blocks added to company's "55" line include Soft-Lite edge treatment (opal-glass fused into the block junction to diffuse light which would otherwise be transmitted through block edge), a fibrous glass insert to further diffuse light, and light-directing prisms on the interior faces of certain patterns.

These features are said to be combined in the blocks in accordance with functional use for which the specific block has been designed. Some blocks are intended for use on south elevations, others for north elevations etc. Blocks with fibrous glass inserts increase light-diffusing effect on extremely sunny exposures. Pittsburgh Corning Corp.

15—FLOW INTERLOCK

Responds to cold water flow to open, close electrical contact

This control device measures approximately 2½ by 3 by 7 in., and is designed to close a contact when a flow of water exceeds a present amount, and opens it when the flow falls below it—acting as a fuse in a circuit which depends on water cooling for protection. According to manufacturer, the interlock can be used as a safety device where it is desirable to actuate an electrical contact with a flow of water.

Adjustment can be made to control circuit for any flow from 1 to 4 gpm. It is stated, and flow differential between cut-in and cut-out of electrical contact is 0.2 gal minimum and 0.4 gal maximum. Interlock doesn't control amount of water flow, but company says this can be done by installing a throttling or regulating valve ahead of the device.

Interlock mechanism comes complete with union fitting and strainer attachment to keep foreign matter out of housing. Designed to operate for amount of flow independent of pressure, the interlock is intended only for cold-water applications. Electrical rating is 10 amp at 125 v, 5 amp at 250 v and 3 amp at 460 v, all a-c. Maximum line pressure tolerated is 125 psi. Control Divs., General Electric Co.

16—TIMING RELAY

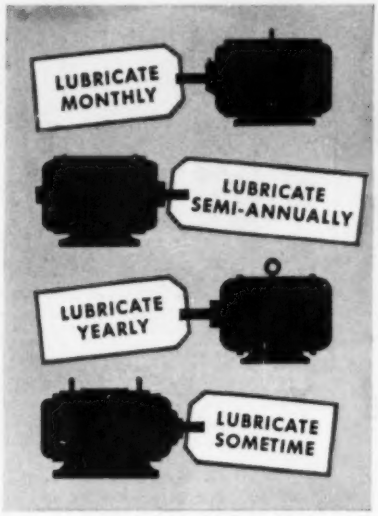
Is adjustable pneumatic timer available for a-c or d-c use

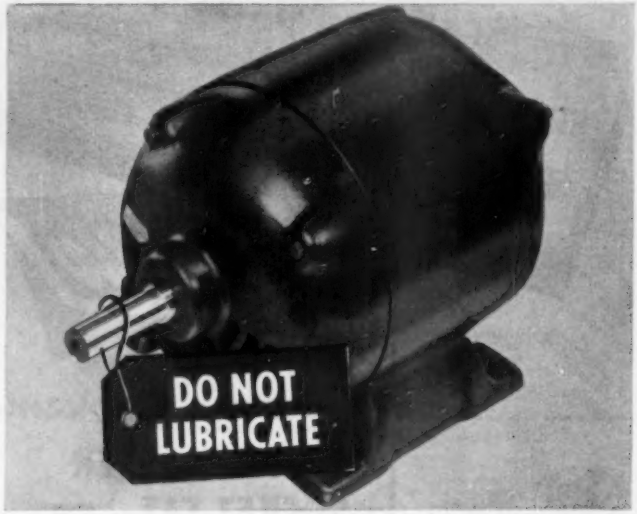
This timer utilizes a synthetic rubber bellows for controlling tripping time. The range is adjustable from 10 cycles to 3 min, with accuracy given as a ± 10 per cent. Relay resets instantaneously, company states, and performance is unaffected by temperature, humidity or vibration.

Timer is available with quick make and quick break double pole, silver alloy contacts—one set normally open and one set normally closed. Duplicate contacts for

YOU CAN BE **SURE**.. IF IT'S

Westinghouse





Why take a chance with "Once-in-a-while" lubrication?

Why fuss with motors that require lubrication "every so often?" Whether it's monthly, yearly, every two or three years, or just an indefinite "sometime," it is as much trouble remembering when to lubricate, as it is to do the lubricating. And it certainly isn't a very good way of making sure bearings get proper greasing attention.

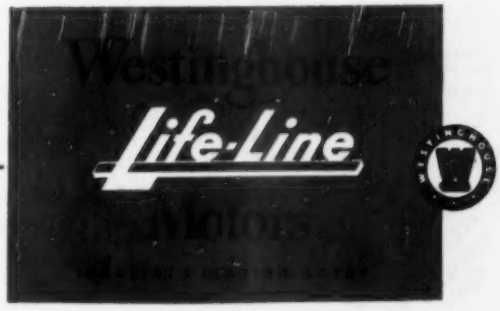
There *is* one way to be *sure*. That's with Life-Line motors. Lubrication is *positive*. Bearings are pre-lubricated and factory-sealed. *No* further lubrication is required!

This is the modern way of lubricating motors. Development of special lubricants, up-to-date manufacturing methods and special seals have made it possible.

Records of nearly half a million motors, operating in every type of industry, indicate that pre-lubricated bearings offer: an average saving of $2.70 yearly per motor . . . 41% fewer motor outages due to faulty lubrication . . . complete freedom from lubrication attention.

Today, periodic lubrication is a costly nuisance. So why take a chance with it when Life-Line offers positive lubrication at no extra cost. See for yourself. Ask your Westinghouse representative for a copy of "Facts on Pre-Lubricated Bearings," B-4378, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21539

If you figure LIFE-COSTS . . . you'll figure LIFE-LINE



It's New!

Snap-on "Supreme"

23-PC. MASTER SOCKET SET Many New Features Combined to Give Mechanics Most Value For Their Tool Dollars!

Patented Palm-Grip Design Handles give a secure hand grip and better appearance.

32-tooth ratchet action—pawl always makes a double tooth contact for added strength.

Easily removed Welch plugs permit cleaning and servicing of friction grip device.

Four-way socket grip makes it easier and faster to interchange various units. Hot broached chip-curled openings give you smooth strong socket walls.

Snap-on metallurgists select only high grade alloy steel to produce Snap-on wrenches.

Controlled heat treating combines surface hardness with skin-to-core toughness in every part of every tool.

Snap-on scores again with a new "Master Supreme" set of four handles, three extensions, a universal joint, and fifteen popular sized sockets. In this ½" sq. drive set you will find highly engineered design, accurate balance, perfect fit, and a comfortable grip, that results in faster, safer, more satisfactory work. Every tool has a full chrome finish for long service life.

Check the features at the left, then ask the Snap-on man to show this set to you. Ask him to demonstrate — try the feel of the tools yourself. You'll agree that mechanics who use dependable tools like these will be a definite asset to your shop.

Over 4000 Snap-on tools are available through 41 direct factory branches located in key industrial areas.

*Snap-on is the trademark of Snap-on Tools Corporation

SNAP-ON TOOLS CORPORATION
8068-E-28TH AVENUE
KENOSHA, WISCONSIN

pilot control can be provided for actuation directly from solenoid. Unit can be changed from "on-delay" to "off-delay" operation by inverting the solenoid. Allen-Bradley Co.

17—HAND HOISTS

In ½ to 4 t capacities, offer light weight and close headroom

These Safeway Hoists are described as compact and easy to handle in tight places. Their construction features simplicity of design, a modern gear drive, Weston type brake, steel load chain, steel housing, self-lubrication, and drop forged top and bottom hooks. Hoists are designed to provide a high safety factor against possible impact loadings. Wright Hoist Div., American Chain & Cable Co., Inc.

18—FLOOR MACHINE

For maintenance work in medium size industrial plants

The Super 12 is an all-purpose machine designed for moderate size floor areas that require more attention than is possible with a small polisher. Besides polishing and scrubbing, the Super 12 is intended to sand, steel wool, and wax floors of all kinds with the aid of several accessories. Concrete floors, for example, can be secured with a wire brush attachment, and rugs shampooed with the addition of a solution tank and shampoo brush.

The motor and brush housing is a single all-aluminum casting to afford protected gear operation with less danger of fouling and give greater splash protection. There are two steel reinforced plastic bumpers—one high and one low on the housing—to protect against marring baseboards, and machine is built low to cover corners hard-to-reach places. Maintenance Products Div., S. C. Johnson & Sons, Inc.

19—REFACING SERVICE

Is available for renewing burned or worn copper contacts

This service consists of renewal of contacts by brazing on faces of silver or silver alloy. Tests show that re-faced parts last

longer than the original, company claims, adding that maintenance is thus reduced and possibility of interrupted electrical service minimized. Cost is said to compare favorably with that of original contact. Superior Carbon Products, Inc.

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 37-38 and 91-92.

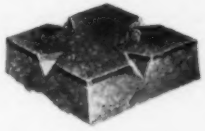
Blue Temper

FEREM FLOORS

Tough Floors for Tough Conditions

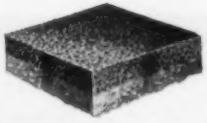
Cement

Notice the porous structure of the ordinary cement floor which is easily subject to crumbling by heavy traffic or shock loads as revealed by the carborundum wheel test.



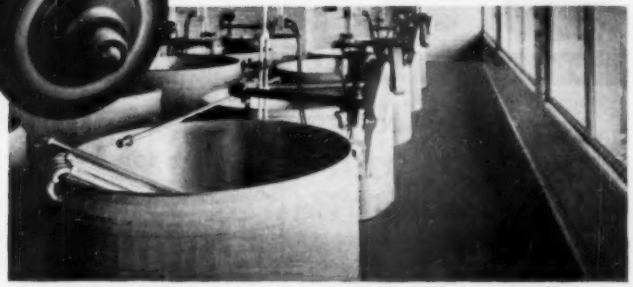
Metallic Hardener

In processed floors using metallic hardeners or metallic plating, the wearing surface is malleable but SLIPPERY and comparatively thin as the wheel test reveals.



Ferem "Blue Temper"

Ferem is the "Blue Temper" component. A dense, ductile and almost diamond hard floor surface results. NON-SLIP and highly wear resistant. The face of the test wheel polishes but does not cut.



20,000 lbs. of Ferem installed at the West Middleton Swiss Cheese Co.

A. C. HORN COMPANY, INC.

Manufacturers of materials for building maintenance and construction—established in 1897

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HORN

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GENTLEMEN:

Please send complete data on FEREM FLOORS.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

KENNEDY
Underwriters' Approved
VALVES

When you need a Valve that's always on duty . . . always ready

Whenever life and property are at stake, the complete reliability and dependability that are built into every KENNEDY Valve are plus safety features. The valves listed below are approved by Underwriter Laboratories and Associated Factory Mutual Fire Insurance Companies.

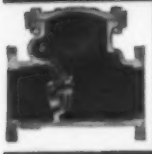
IRON BODY DOUBLE-DISC GATE VALVES

Fig. No.	Type	Sizes	Working Pressures
67	O.S.&Y. Screwed	2½" to 12"	Cold Water, non-shock, 175 lbs.
68	O.S.&Y. Flanged	2½" to 14"	2½" to 12"—Cold Water, non-shock, 175 lbs.; 14"—150 lbs.
681	O.S.&Y. Ball Ends	4" and 6" to 14"	Same as Fig. 68
701	Indicator Post Gate Valve—Flanged	4" to 14"	4" to 12"—Cold Water, non-shock, 175 lbs.; 14"—150 lbs.
702	Indicator Post Gate Valve—Screwed	4" to 12"	Cold Water, non-shock, 175 lbs.
70	Indicator Post Gate Valve—Ball Ends	4" to 14"	Same as Fig. 701

BRONZE VALVES

66	O.S.&Y. Wedge Disc Gate Valve	¾" to 2"	Cold Water, 175 lbs.
38	Hose Gate Valve no cap and chain	2½"	Cold Water, 175 lbs.
39	Hose Gate Valve with cap and chain	2½"	Cold Water, 175 lbs.
93	Angle Hose Valve	2½"	Cold Water, 175 lbs.
935	Angle Hose Valve	2½"	Cold Water, 300 lbs.

IRON BODY CHECK VALVES



125	Screwed Check Valve	4" to 6"	Cold Water, non-shock, 175 lbs.
126	Flanged Check Valve	4" to 12"	Same as Fig. 125
127A	Ball-end Check Valve	4" and 6" to 12"	Same as Fig. 125

INDICATOR POSTS

KENNEDY Indicator Posts provide a safe and easy means of operating valves installed underground or behind walls. Completely enclosed, operation is unaffected by rain, snow, or frost. Highly visible aluminum on black indicator, adjustable to valves of different sizes, protected by extra-thick moist-free glass. For wall or ground mounting.

Write for full particulars ***Buy from Your Local Distributor***

THE KENNEDY VALVE MFG. CO.
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VALVES · PIPE FITTINGS · FIRE HYDRANTS

OFFICE-WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO • SALES REPRESENTATIVES IN PRINCIPAL CITIES

20—FAULT LOCATOR

For finding faults on lead covered cables installed in ducts

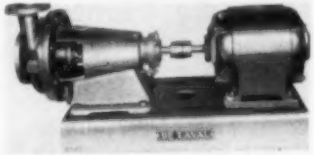
This is a high-voltage d-c impulse transmitter with pick-up coil and pointer indicating detector. Besides its primary purpose, it is said to have applications on aerial and buried cable and in utility and industrial service.

In operation the set is essentially independent of the type of fault or its apparent resistance, company points out, and it depends only on the impulse voltage required to break down the fault. The Model 2-2 is rated up to 20 kv with a discharge capacitance of 2.5 muf, for use on cable up to 15 kv and higher. It requires 500 w to operate from a 115-v source of high voltage d-c for proof testing on all type of electrical equipment. Similar sets of higher and lower kv and muf can be supplied. James G. Biddle Co.

21—PROCESS PUMPS

Are intended for wide range of general service applications

The Type CP Pumps are intended for use in process industries that require handling of hot or cold clear liquids, viscous liquids, corrosive liquids or those carrying suspended solids. They are furnished with open or closed impellers, mechanical seals or conventional packing, and vane characteristics and construction materials can be selected to suit requirements.



Maintenance and operating advantages are claimed for these pumps. To compensate for wear at impeller face, the entire rotor can be adjusted axially by an external adjusting screw. Pumps can be converted from open to closed impeller type and vice-versa. Permanently lubricated bearings are sealed against dust and moisture. Parts are standardized so only two sizes of shafts, shaft locknuts, bearings, bearing cartridges and pedestals are needed for entire line of seven sizes. De Laval Steam Turbine Co.

22—ROLLER CONVEYOR

For handling hot articles or items with sharp edges

The Live Roller Conveyor is ball-bearing equipped and powered by a 60 cycle 110 v a-c master gearmotor. Standard 2 in. rollers are used and spacing may be specified (1 to 5 per foot) in widths of 11½ to 24 in. and in various lengths. Conveyors are mounted on adjustable permanent bases or adjustable portable base stands as specified. Conveyor is intended for horizontal travel, company points out, but will convey certain items up to 10 deg incline or hold them on decline. Metzgar Co.

23—DOOR OPERATOR

For overhead and single sliding or double parting doors

A direct gear drive electric door operator, the Y-M Chief, has an automatic safety switch built into operating unit. This switch is designed to break motor contacts when the closing doors touch an obstruction. The safety control automatically resets itself, company states.

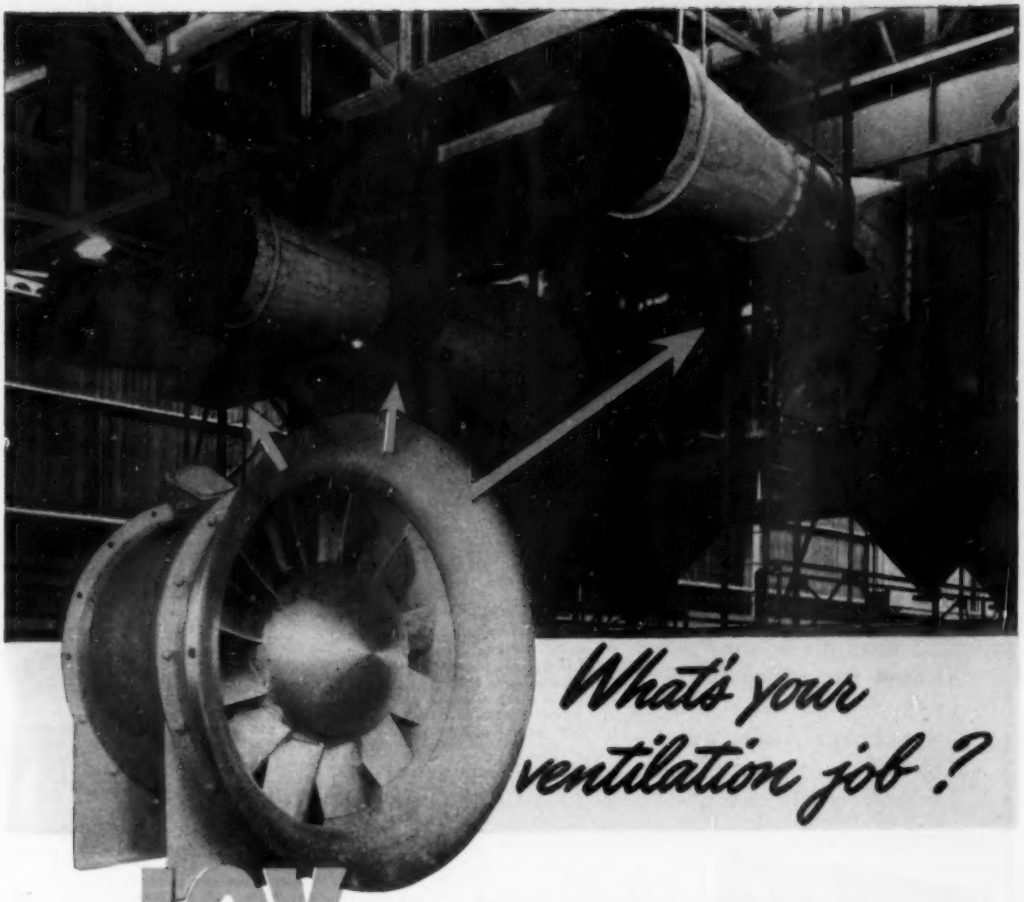
Use of high strength aluminum alloy frame with machined cast iron parts is intended to reduce weight of door operator to provide for easy installation and maintenance-free operation. Door and wall fittings are machined castings. Operator has ball-bearing electric motors of capacities to handle normal door requirements up to 200 sq ft.

The Y-M Chief is supplied with all electrical control apparatus including relay and three-button switch for standard connections to plant power supply. As many stations as desired may be provided for convenient door operation at any practical distance. Yoder-Morris, Inc.

24—SPRING MOUNTING

Heavy duty type for use where rugged isolation is needed

The Type F Vibro Isolator is described as low in cost and recommended for mounting pumps, compressors, fans, engine-



What's your ventilation job?

JOY AXIVANE* FANS

WILL DO IT MORE EFFICIENTLY AND MORE ECONOMICALLY!

Write for Bulletin, or *Consult a Joy Engineer*

From every possible angle, JOY Series 1000 AXIVANE Fans will give you a better, lower-cost job. Their inline, vane-axial design is lighter and more compact; and they operate more quietly, require less power and space, and save greatly on installation time and costs. What's more, you get the extra flexibility of adjustable blades—a standard JOY feature—permitting easy and quick on-the-job regulation of pressure or volume over a wide operating range, with positive protection against motor over-load. ● Whatever your job is, JOY AXIVANE Fans can show you advantages—let us work with you.

*Reg. U.S. Pat. Off.

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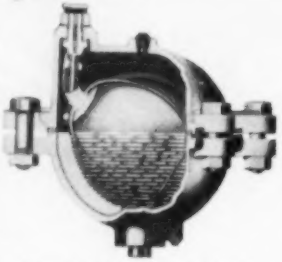
JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

How to get rid of ACCUMULATED AIR IN PIPE LINES . . . *carrying hot or cold water, industrial liquors, sewage and other liquids . . .*

The accumulation of air in water lines under pressure presents the engineer with many problems. Air, lodging at peaks in the line, reduces the effective area of the pipe, creates a friction head, lowers the entire line's pumping capacity, and may result in serious water hammer.



Simplex Air Release Valve

The Simplex Air Valve is easily installed . . . positive in action . . . ample in capacity. Standard valves for pressures up to 250 p.s.i. . . . special valves for pressures up to 800 p.s.i. Thousands have been in successful use for over 30 years.

Simplex Air Release Valves bring a sure, efficient cure for these difficulties. Easy to install, simple in design, positive in operation . . . they vent accumulated air automatically before it can cause damage. To learn how *you* can avoid accumulated-air troubles, send without obligation for our new bulletin.

Send For This Free Bulletin Today!

PARTIAL CONTENTS

Essential Requirements for Air Release Valves
How Simplex Takes Care of Air in Pipes
Methods of Installation
Design and Construction Details

Write to Simplex Valve & Meter Co., Dept. S, 6781 Upland St., Phil. 42, Pa.

IT'S ACCURATE IT'S SIMPLEX

SIMPLEX
VALVE AND METER COMPANY

generator sets. Its heavy duty construction is said to make it especially suitable where service conditions are severe.

The steel springs are guaranteed for the life of the equipment, company states, and provide high isolation efficiency. Housings are malleable castings

sealed by a cylindrical cork ring which is provided to snub horizontal thrust and prevent metal-to-metal contact. Vertical thrust control and sound isolation are also said to be provided. Isolator is furnished with several standard spring capacities for loads from 10 to 500 lb per isolator. The Korfund Co.

25—TELESCOPING SLEEVE

For protecting moving parts, is engineered for flexibility

This telescoping accordion sleeve is made of a combination of rubber, fabric and Gortite for flexibility and strength. It is described as nonhydroscopic, impervious

to oil and water, and of uniform thickness.

Sleeves of this type may be furnished in any diameter or length. According to manufacturer, it permits compression to fit irregular shapes and surfaces and will not crack under temperature changes. A & A Mfg. Co.

26—SILICONE SOLUTION

For treating concrete and cement block against weathering

Stopall Type C and CP is used for keeping water out of concrete and cinder blocks, porous stucco, and sandlime brick. Its use is said to permit oil painting on concrete with lasting results and coverage is 100 to 150 sq ft per gal. Tests conducted by manufacturer, Stopall Waterproofing Manufacturers, Inc., are reported to show excellent resistance to normal weathering conditions. Chemical Dept., General Electric Co.

27—FIRE FIGHTING UNITS

Large stationary type for wide areas where manpower is limited

These massive dry chemical units are built in 500, 1000 and 2000 lb capacities for protection of gasoline bulk plants and storage areas, refineries, chemical plants, public utilities. They are intended especially for industries where only one employee, such as a night watchman, is available for emergency fire duty. One person can operate the unit and fight a fire in any portion of an area several acres in size, company states.

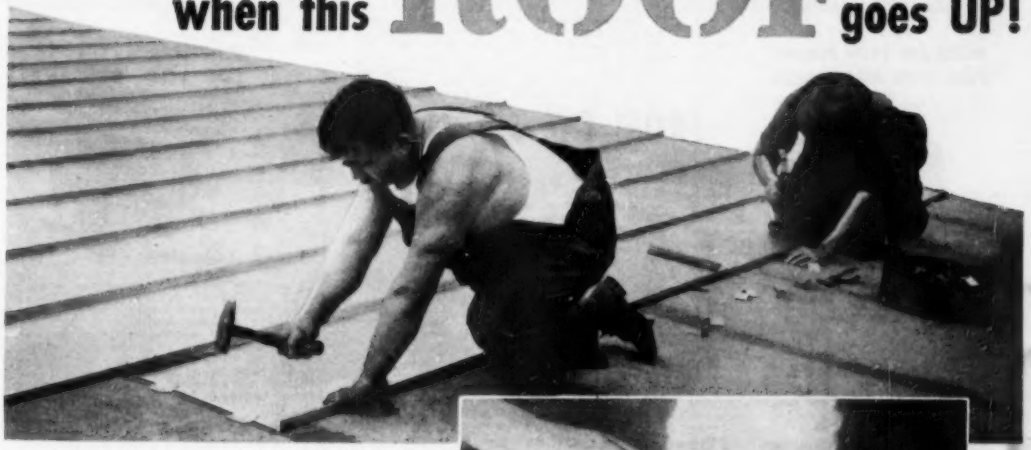
The unit itself consists of a centrally located steel tank containing dry chemical and nitrogen cylinders (to pressurize tank). Piping runs underground from tank to one or more hose houses where

(Continued on page 94)

Do you want more information on this equipment and its application? Use the no obligation, no postage card between 37-38 and 91-92.

Your maintenance costs go Down...

when this ROOF goes UP!



Applying a standing-seam roof of long-lasting Monel.

You can use Monel Roofing Sheet for gutters, flashings, siding or a complete roof at a cost frequently comparable—and sometimes even lower—than that of other quality materials.

And with Monel*, roof upkeep won't be an endless expense.

As a metal, Monel is known for its corrosion resistance and freedom from rusting. That means this ⅔ nickel-⅓ copper alloy is well able to resist attack by smoke, rain and industrial fumes.

Mechanically, too, Monel Roofing Sheet is ideal. It endures heat and cold without buckling or cracking. It has the strength to stand snow, ice and high winds. It takes years of flexing with no signs of fatigue. It resists the eroding action of water, ice and gritty dust.

For further proof, you have the records of Monel roofing installations dating as far back as 1910. (See photo at right.)

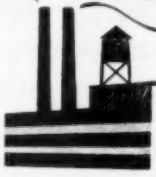
Investigate Monel Roofing Sheet for your own plant buildings. Roofers' quotations on Monel prove that this alloy is practical for even limited construction budgets. And don't forget Monel roofing includes, not only entire roofs, but parts such as drainage systems . . . flashings . . . skylight frames . . . ventilators . . . louvers . . . siding . . . expansion joints . . . copings.

Send for booklet, "ONE METAL ROOF"
It shows typical installations, tells about Monel's many advantages, cites long-service records. Included is a "test-it-yourself" sample of Monel Roofing Sheet.

After cleaning away city grime and dirt, this specimen sheet from a Monel roof installed in 1910 was found to be in excellent condition . . . despite some of the most corrosive atmospheres in the country. NOTE: Sheet was removed for test purposes only. The rest of the roof is still in excellent shape.

MONEL ROOFING

For the "Life-of-the-Building"



EMBLEM OF SERVICE
INCO
TRADE MARK

Architectural Section
The International Nickel Company, Inc.
67 Wall St., New York 5, N. Y.

Please send me a copy of "ONE METAL ROOF" and the sample of Monel Roofing Sheet.

Name.....
Title.....
Company.....
Address.....
City.....State.....

PE—5-50

THE INTERNATIONAL NICKEL COMPANY, INC.

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67 Wall Street, New York 5, N. Y.

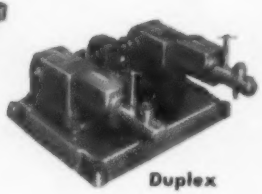
METERING PUMPS
for Every Plant Application

PLUNGER TYPE PUMPS FOR HIGH PRESSURES

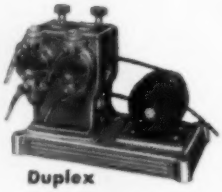
DIAPHRAGM TYPE PUMPS FOR LOW PRESSURES

FROM THE SMALLEST JOB

Simplex



Duplex



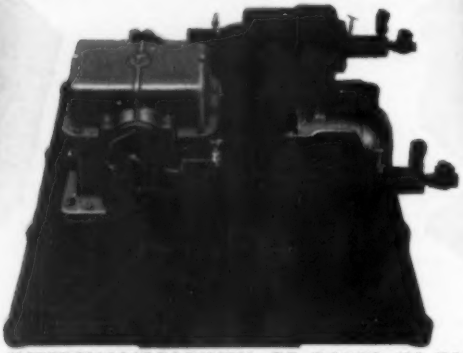
Duplex

Simplex

Also available in Triplex and Quadruplex designs

Also available in Triplex and Quadruplex designs

TO THE LARGEST HIGH PRESSURE INSTALLATION



COMPLETE INTERCHANGEABILITY OF PARTS IN EACH GROUP

NEW MODELS NOW AVAILABLE

• HEAVIER FRAMES • LARGER WRIST PINS • EXTRA HEAVY NEEDLE BEARINGS AND PUSH RODS • STUFFING BOXES SPECIALLY DESIGNED FOR INTERCHANGEABLE STANDARD PACKINGS OR TEFLON SEALS

Write for new Brochure SM-9020 and Bulletin CAT.

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Write to % PROPORTIONEERS, INC. %, 427 Harris Ave., Providence 1, R. I.

Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

Bulletins on Current Plant Problems

(Continued from page 38)

trol works to promote maintenance economy. Discusses advantages afforded and illustrates sample property records. Remington Rand Systems Div., Remington Rand, Inc.

140 Cost Figures on Tool Crib Control—How to figure returns on an investment in company's tool crib control is outlined in Bulletin A-545. Facts on which figures are based cover initial cost, inventory reduction and tool recovery. Also discusses reduced breakage, and machine delays and other benefits afforded. Industrial Div., The McCaskey Register Co.

WATER TREATING

141 Boiler Water Treatment Methods—In illustrated File SM-9020 are discussed several methods of applying chemicals in the treatment of water for boilers. Covers pretreatment of raw water make-up, application of chemical feeding equipment to pretreating operations. Outlines methods of constant rate and flow responsive feeding to feedwater systems and direct to boiler drum, and discusses flushing periods, condensate returns and condenser water treatment, and chemical tanks. %Proportioneers, Inc.%

142 Demineralizing Equipment—Catalog 123, 20 pp, describes in detail the difference between distilled and demineralized water. It highlights the advantages of either distilled water or demineralized water as used in manufacturing and processing operations which call for pure water. It also cites case histories on quality control of water resulting in better products, more uniform results and fewer rejects and lower production costs. It shows how ion-exchange purification works and contains more than 30 illustrations. Barnstead Still & Sterilizer Co., Inc.

143 Water Softeners—Bulletin WC 102 is a 36-pp presentation of recent developments in hot-process water softeners. Explains boiler plant troubles caused by various impurities in water, outlines 12 methods of treating water to eliminate these impurities, gives reasons for popularity of hot-process method and its advantages, and explains chemistry of hot-process water softening. The two basic designs and operation of company's hot process softeners are described, together with six adaptations of each design to various plant conditions, such as percent make-up, treatment of condensate, deaeration. Methods of supplementary hot phosphate treatment are also discussed. Includes more than 30 diagrams of hot process designs and flow charts, together with photographs of installations. Also presents new chemical feeders, filters, and softener accessories. Graver Water Conditioning Co.

MECHANICAL POWER TRANSMISSION

144 Power Drive Handbook—Catalog 709 contains a complete description of company's roller chain and sprockets. Includes tips on selecting stock roller chains for every type of power drive service and other useful data. Diamond Chain Co., Inc.

145 Power Drive—This folder promotes use of company's power drive units designed for many speed reducing jobs, to permit variable speed reduction for any ¼ to 2 hp drive requirements. Gives sizes, specifications, range of speed reductions and prices for both regular models and a heavy duty model. Pictures some of drive's many uses. The Flinchbaugh Co.

146 Tail Pulleys—Bulletin 35, explains how company's specially designed tail pulleys can save wear and tear on conveyor and elevator belts, and includes testimonials covering several installations. Illustrated by photos, gives sizes and prices. Sprout-Waldron & Co., Inc.

PAINTING

147 Painting with Aluminum — Form Ad-228 is a comprehensive 32-pp brochure filled with factual information for all industrial users of aluminum paint. Basically, it explains how aluminum paints can be used to best advantage. It emphasizes that uses of aluminum paint by industry fall into three classifications: 1) for metal, concrete and masonry and other non-absorbent surfaces; 2) for weather exposed wood, and 3) for interior heated surfaces and decorative uses. Generously illustrated, the book uses photos to show proven applications of aluminum paints over the years. Several pages are devoted to questions and answers and an aluminum paint coverage table. Aluminum Co. of America.

148 Plan Before Painting — Under the title, "Your Next Paint Job," Catalog PB136 offers plant engineers many a helpful hint on points to be considered before undertaking a paint job. Illustrated with photos and sketches, many in color, the booklet covers such factors as the principles of contrast control and how to apply them, keeping costs down, exterior painting on various surfaces. Also contains a brief resume of company's paint products telling the chief applications of each. The Tremco Mfg. Co.

149 Pressure Fed Paint Brushes — This illustrated bulletin, introducing a pressure fed paint brush, explains how it is made, how it works, how it is cared for and cleaned, and what its applications and special advantages are. Brush is shown by photo and cutaway drawing. Hanlon & Goodman Co.

CONSTRUCTION MATERIALS

150 Fastenings Data & Reference Book—This finger-tip indexed, reference and data book on stainless steel fastenings is designed to provide you with complete application and authoritative reference information for any industry or application. Separate sections are devoted to machines screws, nuts, caps and bolts, wood and sheet metal screws, rivets, nails, or what-do-you-want? List prices are given, too, along with a quantity discount chart intended to make cost estimating an easier job. Thousands of odd sizes and varieties are listed in a supplementary stock list. The book also tells about company's special item order service. Anti-Corrosive Metal Products Co., Inc.

151 Floor Plate — A rugged, rolled-steel flooring material for safe footing in plants and on manufactured products is the subject of this booklet. It pictures and describes some of the many uses for the plate and its special advantages. Also discusses and illustrates how the plate is fabricated and applied over various surfaces, giving safe uniform loads. Actual size photos of patterns are included along with sizes, ordering data. Inland Steel Co.

152 Open Steel Flooring—This bulletin describes and illustrates forged and welded rectangular patterns and also a triangular reticulated pattern flooring for industrial floors, platforms, walkways, bridges, safety steps, drain grates and trench covers, and also pallets, grid trays and tote boxes. Gives dimensions of each design of grating and step and includes a safe load table. Kerlow Steel Flooring Co.

TOOLS, WELDING

153 Shear Knife Handbook—This 48-pp manual provides a glossary of useful information for plant engineers who specify, use or buy metal-cutting shear knives. Gives recommendations for selection of correct grade for cutting to be done, and presents tips to facilitate ordering. Among knives pictured are sheet, bar, slitter, half slitter, sheet bar, structural, flash trimmer, rotary and pinch knives. Several pages are devoted to standard tolerances in shear knife manufacture, practices in grinding and general care of shear knives. Book is well illustrated and contains utilization data on manufacturer's galvanizing and tinning rolls, composite back-up rolls, automatic handling tongs and C-hooks. Includes charts for calculating coil weight, conversion tables and decimal equivalents, also a grade listing of company's shear knives. Heppenstall Co.

154 Band Saws — The design details, specifications and merits of company's horizontal band saw are presented in illustrated Form 251. Also describes and illustrates stock stands and band saw blades. Wells Mfg. Corp.

155 Pipe and Bolt Machines—This 4-pp folder tells what users say about company's pipe tools. Includes comments on the use and qualifications of a power driven pipe machine representing many types of industries all over the world. Compiled to help plant engineers decide on pipe and bolt machines to serve their own needs. Beaver Pipe Tools, Inc.

156 Stationary Acetylene Generators—This bulletin describes in detail company's generators for stationary installations in welding shops and production plants where a large quantity of acetylene is needed. Generously illustrated with photos

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and cutaway drawings, it discusses advantages of the generators, their construction and operation. Covers both single and double hopper units. Gives specifications, prices and cost comparison figures. The Right Feed Generator Co.

157 Resistance Welding—Bulletin 137-A explains three-phase resistance welding system, its operation, advantages and versatility. Text is illustrated by graphs and wiring diagram. Includes photos and specifications of company's projection welders, spot and seam welders. Sciaky Bros., Inc.

SAFETY, SANITATION

158 Inspection Chart—Faulty fire extinguishers aren't found around plants where extinguishers are inspected regularly, as any plant engineer knows. To make the job simpler this handy inspection form is offered. It's ready to be filled in with types, numbers of extinguishers, their location, dates of inspection and recharging and inspector's comments. On stiff paper, chart may be folded and filed or hung on a wall. Ansul Chemical Co.

159 Women's Watercloset—Form 82 introduces a women's urinal for installation in public, commercial, industrial and institutional buildings. Photos illustrate the new fixture which is designed for use without recourse to physical contact and intended to promote reduced maintenance of toilet rooms and discourage misuse of facilities. Includes testimonials covering test installations and provides tips on where and how to install, also data on dimensions and flush valve arrangements. American Radiator & Standard Sanitary Corp.

160 Washroom Layouts—Blueprint drawings of 30 washroom layouts for industrial and institutional buildings are presented in Bulletin D507, which explains briefly the factors to be considered in good washroom planning. Also includes typical washfountain roughing-in data and illustrates some of company's showers and washfountains. Bradley Washfountain Co.

DUST COLLECTING

161 Dust Collectors — Catalog DC-49 presents high efficiency equipment for the collection and recovery of industrial dust, and provides engineering data covering the design of the collector and possible arrangements of multiple units. Also describes and illustrates testing services offered by company. Presents installation diagrams of equipment in use for catalyst recovery in an asphalt plant, in dehydrating, in the collecting of fly ash in power plants and in other applications. Includes capacity table. The Ducon Co.

162 Dust Collecting—Bulletin 262, "The Use of Dustube Collectors in the Metal Industry" is company's latest industry report. It illustrates methods of using dust control to improve working conditions and quality control, to cut maintenance costs and promote more efficient production on such operations as grinding, blast cleaning, saw glazing. American Wheelabrator and Equipment Corp.

LUBRICATION

163 Centralized Lubrication — Bulletin 803 explains and illustrates a master oiler for providing centralized lubrication for all bearing points on machinery requiring periodic applications of oils. Describes and illustrates system's pump and injector circuit, and includes specifications, installation information. Lincoln Engineering Co.

164 Dry Lubricant—Bulletin 52 explains properties and use of molybdenum-disulfide compound powder for lubricating purposes which has great chemical and thermal stability. Discusses its use as a wear-in lubricant for machinery and dies, for metal forming and drawing and high temperature threaded connections. Price list is attached. The Alpha Corp.

MAGNETIC SEPARATION

165 Magnetic Pulleys — Catalog C-1007A describes and pictures company's permanent non-electric magnetic pulleys for a wide range of industrial separating applications. Tells how this type of pulley operates and discusses and illustrates design features. Includes engineering data necessary to selection of proper size. Dings Magnetic Separator Co.

166 Magnetic Coolant Separator—Bulletin 300-A presents several sizes of company's magnetic coolant separator, in capacities of 1½ to 350 gpm, giving their specifications and general operating characteristics. Includes dimensional layouts and 20 photos of installations with various types of machines. Barnes Drill Co.

MISCELLANEOUS

167 Electric Stairways—Bulletin B-4403, a 50-pp illustrated manual, tells who can expect to profit by using manufacturer's electric stairways, what their advantages are and how they can be incorporated in plant design and plans. Filled with photos of installations, it also describes and illustrates operating mechanism of the escalators, discusses their safety and maintenance and provides engineering data covering layout, design details and dimensions. Elevator Div., Westinghouse Electric Corp.

168 Vibration Control Materials—Characteristics of the various types of vibration isolation media are given in Catalog G-102. In it, 20 typical machine and equipment applications are tabulated in chart form with recommendations for proper types of vibro-isolators for highest efficiency, and with alternates for satisfactory operating efficiency for less exacting requirements. Various types of standard mountings are described with data or loading ranges which run from 10 to 30,000 lb per isolator. Specific purpose isolators and other applications are also described. The Korfund Co., Inc.

169 Wired Television—Illustrated Bulletin 1025, introduces company's Utilscope, a camera and monitor type of equipment designed to enable an observer "to see where he can't look." Some of the many applications for this wired television which are described and illustrated include viewing instrument readings at remote points, checking boiler water levels, watching coal flow in chute, watching hazardous laboratory tests, checking furnace ignition. Also shows the use of several sets in scheduling and assembly work. Diamond Power Specialty Corp.

170 Ball Bearing Swivels — The advantages of company's ball bearing swivels in lessening dangers of wire line breaking, turning freely under maximum load, preventing spinning, twisting and kinking and increasing wire line life are stressed in this bulletin. Photos illustrate available styles, sizes, specifications included. General Machine & Welding Works.

171 Data on Packings — Form 428 is a collection of bulletins covering company's flexible metallic packing, semi-metallic packing, rotary mechanical seal, oil pressure system and steel packing tools. Affords excellent descriptive and engineering data, as well as recommendations for use. In convenient folder, ready for filing. Durametallic Corp.

172 Air Recovery Cells—Bulletin 117-C, 16 pp, presents company's activated carbon air-recovery cells for air conditioning systems and units, to purify air, improve ventilation, save cooling and heating. Tells briefly the purpose, function, application and operation of this type of air cells and discusses its use of activated carbon, also its role in ventilation. Illustrates and gives specifications for air recovery equipment and shows typical assembly arrangements. Includes capacity and resistance curves, cost comparison figures. W. B. Connor Engineering Corp.

173 Packaged Steam Generators — Illustrated with photos and dimensional drawings, Bulletin PG-49-13 describes package steam generators for power or process steam at high or low pressures, for oil, gas or coal firing. Firing arrangements are discussed and illustrated in detail. Foster Wheeler Corp.

174 Vibratory Feeders — Described and illustrated by photo in this 16-pp catalog are variable control vibratory feeders with overhead driving magnets, dual driving magnets, enclosed magnets and infra-red heat lamps for various types of installations and processing requirements. Also covers vibratory feeders for use as long conveyors, wide feeders, spreader feeders and furnace feeders. Also illustrates auxiliary equipment, accessories. Syntron Co.

175 Corrosion-Resistant Alloys — This new edition of company's 40 pp booklet on high-strength, nickel-base, corrosion-resistant alloys, tells the story of the four Hastelloy alloys—what they are, how they can be fabricated and how they can be used to combat severe corrosion. Plant engineers faced with the job of selecting high strength materials that will withstand chemical corrosion will find this booklet a real aid.

In addition to a brief description of each of the alloys, there are tables showing their resistance to common corrosive media. Their strength, toughness, and machinability are given in tables that include properties at room temperature and at elevated and sub-zero temperatures. Graphs compare their properties with those of other common construction materials. Uses of available forms are discussed and procedures for welding, heat-treating, hot and cold working, surface preparation, machining and grinding are given. Haynes Stellite Div., Union Carbide and Carbon Corp.

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For Service and Safety...

Re-Floor with Flintkote

Patching...Resurfacing...complete New Surfacing is quick and easy with cold-laid asphalt mastic mixtures.

You cut cost three ways when you repair or re-floor using Flintkote Flooring Emulsions.

Installation is fast. This means a minimum of preparation to apply and a saving in time loss through interruptions of operation. Mastic made with Flintkote Flooring Emulsions can be hand finished or power floated and opened to normal traffic in as little as 48 hours.

Maintenance is minimized. The resilient qualities of these floors make them truly heavy duty. They absorb shock from heavy loads. They do not require joints. And traffic irons out minor cuts or bumps. Patches may be featheredged.

Service life is long and pleasant. You'll get years of trouble-free service from Mastic made with Flintkote Flooring Emulsions. And a bonus of employee satisfaction goes with it, because these floors offer a comfortable surface on which to work. They're resilient and quiet . . . serve to insulate against cold floors.

So, don't fail to specify Flintkote Flooring Emulsions whether purchasing for your own use or letting a contract, and thereby obtain the floor that gives you top quality . . . while it saves you money. Comprehensive literature is yours for the asking.

THE FLINTKOTE COMPANY *Industrial Products Division*
30 Rockefeller Plaza, New York 20, N. Y.
Atlanta • Boston • Chicago Heights • Detroit • Los Angeles
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FLINTDEK MAKES SLIPPERY SURFACES SAFER!

Whenever slippery floors create a hazard, cut the risk with Flintdek.* This popular oil and grease resistant, anti-slip floor coating is now available in Cement Gray, Slate Gray, Visibility Yellow, Tile Red and Green.

Properly applied by trowel to almost any clean, rigid surface . . . Flintdek will not chip or peel. And areas such as ramps, platforms, steps, around machinery and pools are far safer places to work when surfaced with this durable, anti-slip coating. Write for folder and free applied sample.

*TRADE MARK

FLINTKOTE *Products for Industry*

(Continued from page 88)

1-in. chemical hose is coiled. Hose comes in 50, 100 and 150 ft lengths.

Rate of flow of dry chemical is 450 lb per min. Recoil is said to be minimized with a specially designed nozzle. Effective range is given as 35 ft. The 500 lb model is equipped with a 265 cu ft nitrogen cylinder, the 1000 lb model is pressurized by two such cylinders and the 5000 lb unit by four. Number of hose houses and piping outlets are determined by plant's needs. Ansul Chemical Co.

28—OPEN FLOODLIGHT

Is a 750-1500 w, porcelain type, for general area lighting

The VE-18 is of one-piece welded steel with porcelain enamel finish, gray outside, white inside, with average reflectivity described as 82 per cent or more, with beam spread approximately 135 deg. Beam efficiency is said to exceed 70 per cent.

A bracket is available to extend company's swing-over feature to bayonet heel construction floodlights. The hood of this bracket is corrosion-resistant cast aluminum. Westinghouse Electric Corp.

29—POWER SWEEPER

Is vacuum equipped, high speed type for one-man operation

Though less than 29 in. wide, this machine is said to have a sweeping capacity of over 43,500 sq ft per hr. Extra-clean sweeping is credited to its combination brush-and-vacuum system. A 24 in. wide brush revolves inside a sealed-to-floor compartment, hurls dirt into a built-in hopper. At the same time a vacuum fan draws dust into a heavy fabric bag. The hopper is designed to compensate for irregular floor surfaces and bulky debris.

Use of a two-speed transmission gives sweeper speeds up to 8 mph for open areas, down to 2 mph for narrow areas. Since brush and vacuum fan are powered directly from the 4.4 hp air-cooled engine, suction pick-up is claimed equally efficient at any speed. Sweeper has reverse gear, front wheel steering, foot and parking brakes, sealed ball and roller bearings. Various brushes are available. G. H. Tennant Co.

30—PLATFORM HOIST

For maintenance and inspection work at all elevations

The Bosun's Chair is a rigid tubular steel cage moved by a winch. Sitting on a bicycle-type saddle having two coil springs, the worker operates standard bicycle pedals to raise or lower hoist. Seat height is adjustable, and it's possible to work from a standing position.

Power is transmitted from pedal crank to winch drum by a roller chain on sprocket wheels. Movement of hoist may be as fast as 25 ft per min, under control of operator. With a rated capacity of 625 lb, this hoist is furnished with 150 ft of $\frac{1}{4}$ in. 6 by 19 plow steel wire rope. Weighing only 75 lb, it is intended for one-man operation and quick rigging.

Hard rubber rollers on the front of the unit are provided to prevent marring of working surfaces and make it easier to raise or lower the hoist. Safway Steel Products, Inc.

31—AUXILIARY MOTOR

Is base ventilated, for driving outdoor power station auxiliaries

Available in ratings from 200 to 3000 hp, this motor was developed for outdoor installations where totally enclosed fan-cooled units are not available. It is designed to be mounted on a concrete base raised sufficiently from ground to allow contaminated ambient air to flow through foundation at high velocity. Ventilating air enters motor through vertical passage in base and is pulled from ambient air stream at low velocity. Almost no water can be carried up vertically into motor, it is said, but baffles within air intake passage are provided to eliminate even small amounts of foreign matter.

After circulating through motor, ventilating air is exhausted from protected ports at the top. If air enters exhaust ports during heavy storm, adequate elimination and drainage are provided, company points out, and if surrounding air has high cinder content, a coarse mesh screen may be added. Small and Medium Motor Divs., General Electric Co.

32—QUICK COUPLING

Comes in 6-in. pipe size for heavy-duty applications

This large coupling, the 1700 Series, is designed for fast connecting and fast feeding, is light weight and compact, and operated without tools. Dimension between flanges is 7 in., and weight is 17½ lb. Coupling is rated at 150 psi.

The quick disconnect principle employed is described as a positive acting, vibration proof type. A 40 deg turn makes or breaks the coupling, and locking is effected with $\frac{5}{8}$ in. steel balls. Mating parts are tapered and seal is an easily-replaceable O-ring of synthetic rubber.

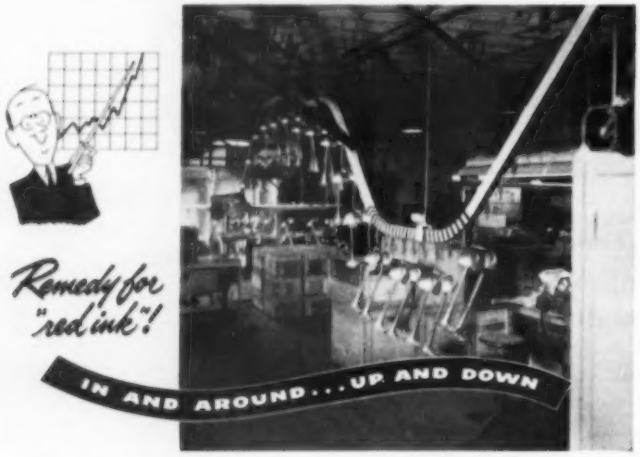
Coupling body has a standard 6-in. commercial pipe flange. Mating nipple is available with either flanged or threaded end. Coupling has ring handles for winch use, and provision for safety chain attachment. Couplings and caps are available in heat treated aluminum alloy; nipples are heat treated alloy steel. Roylyn, Inc.

33—HEIGHT MEASURER

Combines features of telescope with those of microscope

The Height Gage Scope, designed for attachment to any 18- or 24-in. height gage, has five power magnification, coated lens, internal focusing, and wide field and is said to provide an erect image throughout a working distance of 2½ in. to infinity. It measures dimensions which can be seen but not touched. The dash-lined crosshair will distinguish 0.001 in. at 2 ft and has a concentric circle for picking up hole centers. Measurements are read directly on the height gage vernier.

With height gage mounted horizontally, instrument serves as toolroom microscope. Instrument checks hard-to-reach places such as dimensions on points and wires and through transparent objects. Inspection of tapered cylinders, recesses, ordinate stations on cams is said to be relatively simple. The scope is 9¼ in. long, 1⅞ in. dia and weighs 12 oz; its case fits in regular height gage box. Priced at $88.35. Quality Control Co.

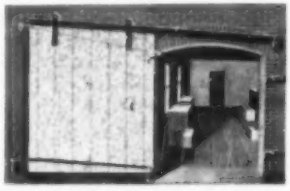


R-W "ZIG-ZAG" continuous power conveyors raise productivity . . . lower costs

In almost every imaginable industry, R-W Zig-Zag Conveyors are serving production and processing lines—increasing efficiency, cutting costs. Specifically designed to carry light loads through confined, crowded areas, Zig-Zag breaks costly "bottle-necks," and helps put production on a more profitable basis.

"ZIG-ZAG" Pays for Itself

Our files are filled with evidence which proves conclusively that the savings effected with R-W Zig-Zag Conveyors are so substantial the equipment quickly pays for itself—in most cases in *less than a year!* So, to put your plant in position for peak profits, convert now to Zig-Zag—the modern method for continuous overhead transportation and processing of materials. For complete details—all the facts about R-W Zig-Zag Conveyors, contact the nearest office of Richards-Wilcox.



R-W No. 2102 Hardware with No. 647 labeled "Fyre Ward" flat surface steel door.

R-W OFFERS COMPLETE LINE OF FIRE DOORS AND AUTOMATIC FIRE DOOR HARDWARE . . . the most comprehensive line of fire door hardware, fire doors and fusible links on the market.

1880 1950 OVER 70 YEARS

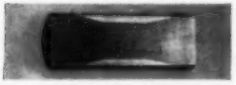
Richards-Wilcox Mfg. Co.
"A HANGER FOR ANY DOOR THAT SLIDES"
AURORA, ILLINOIS, U.S.A. Branches in all principal cities

Do you know how the new Metallizing method can help you slash repair costs?

Knowing the right answers to these questions might help you cut repair costs very substantially.

Question *Will metallizing give me a good job every time?*

Answer — Yes. Previously, when preparation for metallizing involved *seven* separate steps, a slip-up in any one step could result in a poor job. But now, Metco's new Sprabond Wire enormously simplifies preparation. You spray this new self-bonding material directly on smooth steel and many other materials with no preparation beyond thorough cleaning. You get a perfect bonding surface. You get a good job every time.



Cut-away view showing typical build-up over Sprabond Wire preparation coat on steel shaft section. With Sprabond Wire, dovetailing of the coating is often unnecessary and the metallized build-up may be brought to a feather edge.

Question *Where does metallizing pay off?*

Answer — It's ideal for the repair of worn machine parts. It is not recommended for use on parts subject to severe impact (dies, punches, etc.); point stress (ball bearings, etc.); or elongation (gear teeth, threads, etc.). *But it will cut repair costs as much as 90%* on parts such as pump shafts, crankshafts, motor shafts, turbine shafts, transmission and worm shafts, spindles, lathe beds, pump plungers, impeller shafts and many others. Also good for fast, economical repair of cracked engine blocks, heads, casting defects, permanent molds, patterns, etc.; thin sections which would be distorted by other methods; strongly bonded coatings on aluminum and magnesium.

Question *How fast is metallizing?*

Answer — Modern metallizing guns deposit as much as 20 lbs. of steel per hour. With the new Sprabond Wire process, you can put repaired parts back in service, often in a matter of minutes, instead of hours or days.

Just 3 Fast Steps in Restoring Worn Crankshaft Throws

1. Rough, cleaning cut taken and Sprabond Wire preparation coat applied. 2. Throw metallized with .80 carbon steel. 3. Throw finished to original dimension.

Question *What other advantages has metallizing?*

Answer — Special long-wearing and corrosion-resistant coatings can be applied to inexpensive base metals. Microscopic pores in the surface of the metallized coat form tiny oil reservoirs that improve lubrication, usually outwear virgin metal. Low heat generated (150° to 250° F) eliminates danger of distortion. Metallized surface is smoother, requires less finishing, wastes less metal than other methods of metal build-up; choice of 32 different metals available in wire form.

Question *Is metallizing installation expensive?*

Answer — No. Metco's four gun models, ranging from the heavy-duty Type "Y," down to the new light-duty Type "L," which operates on 10 cubic feet of air per minute (3 hp compressor), permit choice of installation to fit a plant of practically any size. The original equipment cost is often recovered in the savings of time and material on just one or two important repair jobs.

Do you have some questions on metallizing that have not been answered here, or a special problem in machine repair? We will be happy to send further information, or have a Metco Engineer call in person. No obligation, of course.

The following names are the property of Metallizing Engineering Co., Inc. Sprabond Wire, METCO*

*Reg. U. S. Pat. Off.

METALLIZING ENGINEERING CO., INC.
38-13 30TH STREET — METCO METALLIZER — LONG ISLAND CITY 1, N. Y.

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METALLIZING ENGINEERING CO., INC.
38-13 30th Street, Long Island City, 1, N. Y.

Please send free booklet — "Metallizing Saves Money."

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COMPANY _____

STREET _____

CITY _____ ZONE ____ STATE _____

A CLEAN Plant
Is a SAFE Plant

TORNADO*
one-stroke, positive pick-up
Industrial
VACUUM CLEANER

The TORNADO* Method is the accepted, approved method of good "shopkeeping" and preventive maintenance. Reduces plant hazards.

TORNADO* is fast, thorough and efficient. Reduces labor and maintenance costs because one-stroke over the surface is all that is required. No need to waste time by restroking. Picks up wet and dry substances as they come—water, machine oil and other wet substances without machine adjustment. Leaves surface safe for workers. Increases morale. Eliminates health hazards.

TORNADO* does all plant maintenance work with one machine. Motor unit removed in seconds to become a powerful, portable electric blower. Clean dry air blows out dust, dirt, grime and abrasive grit from interiors of motors, machinery and overhead equipment to reduce friction and hold break-down to a minimum. Equipped with tank, it becomes an efficient insecticide sprayer which shoots a fine mist to a distance of 50 feet. May be further converted into a compact, pack-carried vacuum cleaner for use in congested areas and other confined places.

Proved by over 16 years of industrial service to be the most practical cleaner for all plant maintenance. A clean plant is a safe plant.

Bulletin 592 contains complete information. Write for it.

*Trade Mark Reg. U. S. Pat. Off.

BREUER ELECTRIC MFG. CO.
5086 Ravenswood Ave., Chicago 40, Ill.

Plant Layout

(Continued from page 51)

where this could not be done, in minimizing the fixed nature of each as much as possible; and secondly, in so placing these installations in relation to the work groups arranged around them, as to permit an area and direction of expansion radially outward.

Figure 2 shows a typical example of the application of the first principle. A simple "T" angle is used as a standard guide for assembly dollies rather than expensive mine track. Its use eliminates the expense and time-consuming necessity of digging up concrete floor, and utilizes a single above the floor rail which needs no frogs or switches. It is obvious that in time of need it is much more readily and inexpensively relocated than the mine track. The stock racks previously illustrated, also are in keeping with this principle. They may be changed very readily to accommodate larger or smaller sizes.

In accordance with the second principle the engine was divided, as far as the organization of Initial and Final Assembly activities is concerned, into seven major sections. These were more or less arbitrarily arrived at based on an over all estimate of the probable need for major facilities in connection with each section, and the probable success to be achieved in minimizing their fixed nature. Every effort was made to permit one installation to serve at least two major sections. The application of this principle is most clearly evident in the layout of the Compressor and Turbine Frame Sections of Final Assembly.

Fire-Protect Asphalt Tanks

ASPHALT TANKS present an unusually difficult fire protection problem. Process temperatures are near the flash point and the asphalt can ignite readily, making an intense, destructive fire. Under some conditions, extinguishing agents cause the heated asphalt to foam over, spreading the fire. On cooling, the spilled asphalt hardens into a solid mass that must be dug out, a long, tedious job during which the process is usually out of production.

Preventing fires in asphalt tanks is largely a matter of preventing overheating. Automatic temperature controls are necessary, as well as high-temperature limit switches arranged to shut off the heat or sound an alarm.

Portable extinguishers recommended for asphalt fires are the dry chemical type. Fixed extinguishing systems are also needed under ventilating hoods at open tanks, either water spray or foam applied from overhead nozzles, but such installations must be carefully engineered. The building itself should have automatic sprinklers to protect it in case of fire in the tank. *From Factory Mutual Record, Mar. 1950, a publication of Factory Mutual Engineering Div. of the Associated Factory Mutual Fire Insurance Companies, Boston 10, Mass.*

LOW-COST
SOLID TEFLON
RING GASKETS

Now Stocked
in Standard Sizes
for Immediate Delivery

You can now get solid Teflon ring gaskets in many standard sizes at mass production prices from stocks in Camden, Houston and Chicago.

In case you haven't discovered Teflon's advantages as a gasketing material, this DuPont wonder plastic is completely inert to all chemicals. Teflon cannot be attacked by nor contaminate any industrial material conveyed in piping. Thus, it is never necessary to change Teflon gaskets to suit changes in materials conveyed.

Teflon's natural slipperiness prevents any sticking of these gaskets. Extremely *antibesive*, a Teflon gasket is never defaced or torn when joints are opened. Teflon gaskets can be used over and over before needing replacement.

Sizes from 1 in. to 12 in. nominal ID for 125-150 and 250-300 lb. pressure series. Thickness—1/32, 1/16, or 1/8 in. Prices on request. Write Houston—2415 San Jacinta St.; Chicago—343 S. Dearborn St. Camden address below.

Also available—Teflon sheets, rods, tubing, bars, cylinders, and bulk Teflon packing.

Teflon Products Division
UNITED
STATES
GASKET
COMPANY
648 N. 10th St., Camden, N. J.

FULLER ROTARY COMPRESSORS

Four Fuller Rotary Two-stage Compressors installed in a steel mill. Capacity each, 1065 c.f.m., 100-lb. pressure.

Facts

that prove our case!

• • • FULLER ROTARY COMPRESSORS *are built for* 100-125-LB. PRESSURE

Many users of compressed air, we find, are laboring under the false impression that Fuller Rotary Compressors are built only for low-pressure operation. To refute this impression, we list below, only a few cases in the steel industry, which show installations of two-stage machines, operating at high pressures.

	TOTAL FULLER ROTARIES PURCHASED	FOR HIGH-PRESSURE OPERATION
Company A	8	6
" B	6	5
" C	4	4
" D	28	23
" E	7	6
" F	21	21
" G	5	5
" H	4	4
" I	17	11
" J	19	18

The next time you are in the market for compressors, or vacuum pumps, may we have the opportunity to tell you more about Fuller Rotaries?

FULLER COMPANY

CATASAUQUA—PENNSYLVANIA

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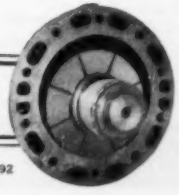

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Refrigeration

(Continued from page 66)

sure energy in the process. This may be done in one of three ways: By the use of a casing volute; with a vaned diffuser; or vaneless diffuser.

The last method is most popular with commercial refrigeration centrifugal unit manufacturers because it is simple to make, being nothing more than the empty space between two radially extending walls. However, the N.A.C.A.[2] have shown that for maximum efficiency the outside diameter of the vaneless diffuser should be about 2.5 times the diameter of the impeller. Strict adherence to this ratio results in a very large casing diameter so manufacturers compromise with a ratio of about 1.70. This leaves more kinetic energy in the vapor to be dissipated.

12. The Refrigerator Capacity.

This is the actual refrigeration supplied to the cooled liquid based on its measured flow and drop in temperature while passing through the evaporator.

13. Correction Factor.

To correct test conditions to conditions of zero superheat at suction and zero sub-cooling of the refrigerant liquid in the condenser a correction factor must be applied to the values obtained on test for brake horsepower per ton and the refrigerator capacity.

All of the preceding applies to a centrifugal refrigerating system regardless of whether the compressor is motor, engine, or turbine driven. Obviously only the motor driven unit is likely to be of a hermetically sealed design. Engine drives would not normally be used. With a turbine drive it would be necessary to rely on the manufacturer's test curve for brake horsepower output. If the turbine steam inlet and exhaust conditions do not correspond to the original test values a correction to power output would have to be made. If the turbine blades have remained clean and free from deposition of solid materials carried in the steam and the blade edges show no sign of erosion or corrosion the test curve can be considered valid.

In order to obtain values for the criteria of performance previously discussed it is necessary to proceed with a test program for the purpose of obtaining the pressures, temperatures, flows and power measurements at the points illustrated in Fig. 1. In addition to these measurements it is necessary to record the local atmospheric barometric pressure prevailing at the time of each test run to establish the absolute vapor pressure of the refrigerant in the system. This in turn settles the temperature corresponding to saturated conditions of the vapor in the evaporator and condenser.

[2] National Advisory Committee on Aeronautics, and government agency with extensive facilities for testing aeronautical and related equipment.

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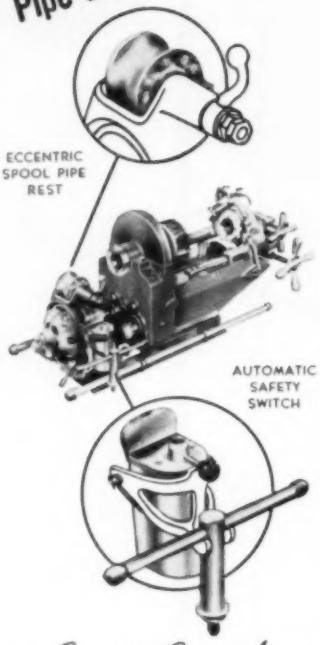
BEAVER Model-A

Pipe and Bolt Machine



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Two new improvements—patents pending—have been added to further increase the safety, convenience and performance of the Beaver Model-A 1/8 to 2" Pipe & Bolt Machine—popular the world over for the past 19 years.

1. The new Automatic Switch Lock and Chuck Wrench holder makes it impossible to start the machine without removing the chuck wrench. This protects both workmen from injury and machine from damage. A highly important Safety Feature.
2. The new Eccentric Spool Pipe Centering Device is detached from the rotating spindle—prevents the whip of long revolving lengths of pipe from rocking the spindle and causing flat-sided, leaky threads.

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WHERE THE HORIZONTAL

MEETS THE VERTICAL

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And unless your freight elevators are a planned part of your overall materials handling system, the efficient flow of materials is interrupted . . . and your handling costs rise.

To help you plan vertical transportation that meshes with your horizontal, Westinghouse has produced a new book, "The Buyer's Guide For Freight Elevators" (B-4402). This book, the most complete source of information available on freight elevators, can only be obtained by requesting it on your company letterhead. Write Elevator Division, Dept. N, Westinghouse Electric Corporation, Jersey City, N. J. J-98564

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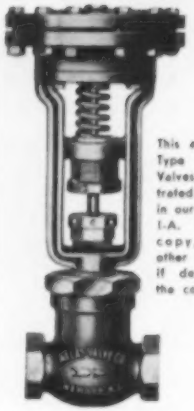

This and other ATLAS Type "D" Reducing Valves are fully illustrated and described in our 52-page Bulletin 1-A. You can get a copy, plus data on other ATLAS products if desired, by using the coupon below.

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VALVES

201 Valves and Specialties for Corrosive Services—Gate and needle valves, screw machine products, hose nipples, tubes, flanges, hot rolled bars and welding electrodes described in Bulletin W-350-35B are made of Worthite, a stainless alloy produced for company's in equipment for handling various corrosive solutions. Gives sizes, specifications for equipment listed, includes photos. Worthington Pump and Machinery Corp.

202 Blow-Off Valves—Bulletin B-424 is a 24-pp catalog covering blow-off valves for low and medium pressure boilers. Describes and illustrates construction details for seatless valves and double-tightening valves. Includes specifications, dimensions, weights and prices on valves and parts. Pictures many installations. Yarnall-Waring Co.

203 Gate Valves—Specifications, sizes, and dimensions for bronze gate valves of heavy duty construction for use on steam, water, oil, or gas lines are provided in pocket-size Circular 102. Brief text discusses maintenance, installation and operation. Illustrations show screwed and bolted bonnet types, design features. The Kennedy Valve Mfg. Co.

204 Reducing Valve Engineering Data—Bulletin 962 presents data on pressure reducing valve, explaining how its streamlined contour contributes to efficiency of performance. Discusses and illustrates valve's straight-line flow, wide opening, tight closing and other design features. Includes sizes, dimensional data and steam and air capacity charts. A. W. Cash Co.

205 Air Control Valves—Folder A illustrates 20 air-controlled valves, showing two-way, three-way and four-way air flow and indicating open, closed and exhaust positions. Text briefly covers special design features, sizes, basic types, capacities and available metals. Valvair Corp.

206 Air Release Valves—Bulletin 1200, 8 pp, devoted to company's air release valves, includes a discussion on air in water pipe lines and the essential requirements for valves of this type. Illustrates methods of installation and explains valves' construction and operation. Covers types for standard, high pressure and special services. Contains photos and diagrams of the valves and a large cross section showing materials of construction. Simplex Valve and Meter Co.

MATERIALS HANDLING

207 Overhead Handling Equipment—In Bulletin C-1, 56 pp, are more than 100 photos of overhead handling equipment in use in all types of industries. Sketches of trolleys, cranes, switches, track and auxiliary equipment show construction, safety features, electrical advantages. Book also discusses engineering services offered, includes data sheet for requesting information on special problems. The American Monorail Co.

208 Industrial Jacks—Catalog 50 is a 28-pp ordering book covering single acting rachet lowering jacks, track jacks, screw jacks, hydraulic jacks, push and pull jacks, reel jacks and related equipment and accessories. Gives sizes, capacities,

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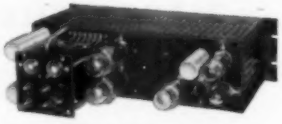

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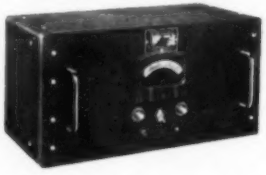

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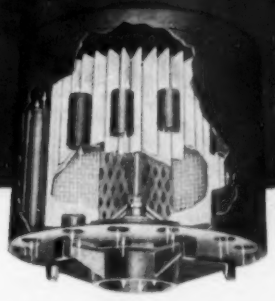

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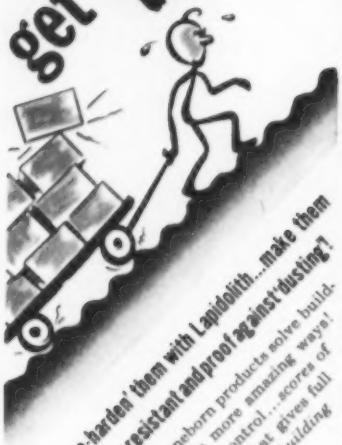

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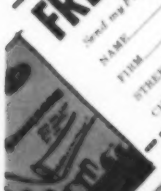

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weights; tells applications. Templeton, Kenly & Co.

209 Materials Handling Equipment—Catalog 23, 80 pp describes most types of company's power trucks, power jacks, stackers and cranes, hand trucks, platforms and storage racks, and related equipment. Fully illustrated with photos and drawings it includes specifications, capacities, sizes and application data. Lewis-Shepard Products Inc.

210 Handling and Processing Equipment—Catalog 791, 32 pp, presents line of feeders, bin valves and level indicators, reduction machinery, vibrating screens and processing equipment, magnetic separators, elevating and conveying machinery, barrel packers, electrical controls for vibrating units, also chains and transmission machinery. Illustrated with photos and sketches of units and installations. Gives typical applications and advantages of equipment, explains operation, includes specifications, sizes. The Jeffrey Mfg. Co.

211 Conveying Systems Manual—Unloading and conveying of dry pulverized material are discussed in 24-pp Bulletin FK-25. Text covers complete system and its operation, also stationary pump and related equipment and is illustrated by photos and dimensional drawings, with sizes listed. Several installations of conveying equipment are described and pictured. Also presents an air compressor for use with conveying systems, and remote-control unloader. Fuller Co.

212 Electric Hoists—Catalog H-46 is a 44-pp manual covering monorail and stationary hoists and car pullers and providing helpful information on fundamental types of grabs, methods of hanging I-beams, types of hoist suspension, types of controls and factors to be considered before ordering. Contains full specifications and dimensional data, illustrations of models, many photos of installations. American Engineering Co.

213 Freight Elevator Buyer's Guide—How to integrate selection of freight elevators with materials handling needs is among questions answered in Booklet B-4402, 44 pp. Ten illustrated sections explain basic considerations involved, also component parts of freight elevators. Covers lifting capacity and size; control systems; methods of door operation; layouts for standard freight elevators; types suited to plant needs; budget price information, and typical and special installations. Elevator Div., Westinghouse Electric Corp.

214 Conveyor and Elevator Belting—Full engineering data covering company's line of belting for conveying jobs and industrial elevator installations are provided in this 24-pp illustrated handbook. Also describes and gives application information and specifications for these beltings. Technical data is clearly presented so as to simplify selection and ordering. Republic Rubber Div., Lee Rubber & Tire Corp.

215 Overhead Handling Equipment—This is a booklet of engineering and application data on company's tramrail equipment. In addition to discussing what this equipment can do toward increasing a plant's handling methods, it illustrates and describes in detail the system's rail and arch design, switches, cranes and transfer bridges, hand operated carriers, hoists, cranes, buckets and grabs. Cleveland Tramrail Div., The Cleveland Crane & Engineering Co.

216 Conveying Equipment—Illustrated Bulletin 147R presents roller conveyors designed for efficient handling of cases crates, boxes and containers. Photos show flexibility and other features of the equipment, also special models and typical installations. Speedways Conveyors, Inc.

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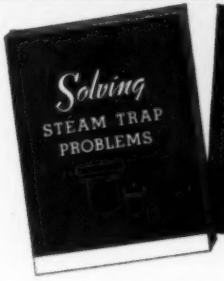

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217 Wheeled Lift Jack—This bulletin tells how one man and a pair of company's jacks can handle loads up to 2000 lb. Shows how a twist of the toggle arrangement lifts the heavy, bulky load off the floor and puts it on roller bearing wheels. Stresses efficiency in moving crates, file cabinets, display fixtures. The Winkiemann Co.

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218 Conditioning Units—The advantages of self-contained conditioning units and their applications in cooling, dehumidifying and cleaning are given in illustrated Catalog 1307, 40 pp. Explains installation and operation. Includes complete engineering data on direct expansion cooling, cold water cooling, hot water heating, steam heating. Also includes speed and horsepower tables, dimensional data on both horizontal and vertical types, psychometric chart and typical problems involving choice of unit size, number of rows of coils, determining speed and motor horsepower. Clarage Fan Co.

219 Humidifiers—Illustrated Bulletin 1772 covers line of steam humidifiers, including two new air-controlled models. Includes discussion of dry air problems, tables on desirable relative humidities and regain of hygroscopic materials, complete data on operation and installation of both electric and air-controlled types. Also tells how to select humidifiers, giving capacities and prices. Lists and illustrates air-operated and solenoid-operated valves for use in humidifier control. Armstrong Machine Works.

220 Cooling Towers—Section 42 covers induced draft cooling towers for small water-cooled air conditioning and refrigeration condensing units. Illustrates towers and pumps, and discusses applications, operation and installation of the towers, giving specifications. Includes typical installation diagram, capacity and performance tables, also tower and pump selection table. Binks Mfg. Co.

ELECTRICAL

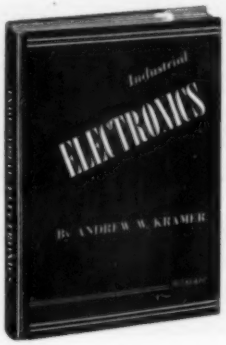
221 Round Type Ventilators—Engineering data necessary to the selection of the correct ventilator for individual plant conditions is presented in 16-pp Catalog V-13-49. Discusses factors influencing efficiency of roof ventilators and features to be checked before undertaking their selection. Describes and illustrates gravity type, several fan types and a foundry type, giving specifications, dimensions and exhaust capacities as well as general ventilator data. Photos show several installations. H. H. Robertson Co.

222 Motor Data—Bulletin MU-185 is a collection of more than 60 pp of engineering and descriptive data on company's line of motors. Covers many types, including splash-proof and explosion proof motors, gear motors and motors intended for use in chemical plants, for oil well pumping, punch press motors, elevator, crane and hoist motors. Illustrated throughout; includes price lists. Wagner Electric Corp.

223 Voltage Control—Bulletin 547, covering variable transformers and voltage regulators, illustrates and describes available models, stressing their special features and including specifications, dimensional data, ratings and connection arrangements. Also presents electronic electro-mechanical regulators. Includes price list. The Superior Electric Co.

224 Selenium Rectifiers—Booklet DB-19-025 on standard and high-voltage selenium rectifiers for power supplies and electronic circuits gives efficiency curves for both types, together with discussions on efficiency and service life, back leakage and reverse resistance and forward resistance. Life characteristics of both cell types for various overload conditions or high ambient temperatures are plotted graphically. Includes tabular presentation of schematic diagrams, formulas for calculating rectifier performance, and cell ratings. Westinghouse Electric Corp.

225 Capacitor Motor—Bulletin GEA 5401 presents integral horsepower, single-phase capacitor motor, illustrating and discussing its compact size, transfer mechanism,



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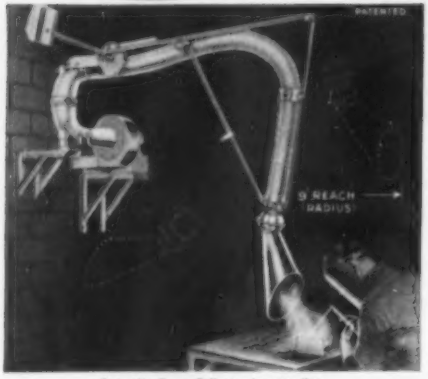

Ruemelin Fume Collector in operation.

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated at their source, thus improving working conditions, lessening fatigue and paving the way for increased plant production.

The Ruemelin Fume Collector hood can be instantly placed where needed anywhere in the booth welding area. No tedious adjustments necessary. Just pull the inlet hood to the welding position and you are ready to go. Approved by state industrial commissions and by compensation insurance companies. Simple to install. Thousands in service. Many users send in repeat orders. Write for bulletin 37-D today.

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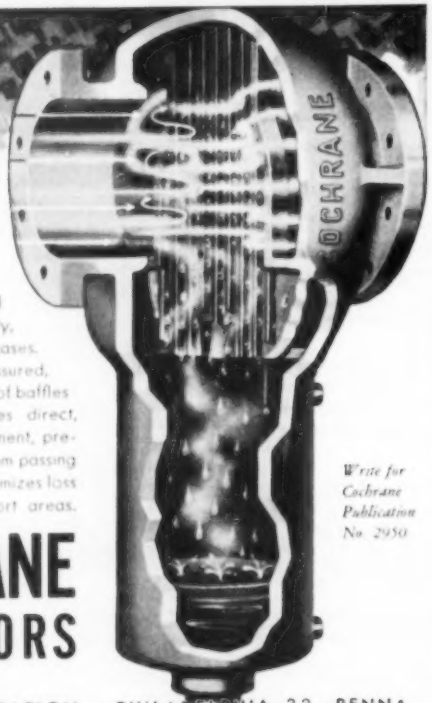

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bearings, and terminal board. Emphasizes long service and protection against damage, breakdown and operating wear afforded. Also stresses motor's easy installation and quiet operation and explains company's motor exchange plan. Gives specifications, characteristics of motor, and elaborates on construction features. Apparatus Dept., General Electric Co.

226 Power Distribution Feeders—Catalog TEB-1, 40 pp, is devoted to heavy-duty units used as main feeders in company's power distribution system, giving construction details, engineering data, application tips. Includes comparative analysis between this and other methods of power distribution on basis of cost and performance. Also contains full listing of parts, telling how to specify, order and install equipment. The Trumbull Electric Mfg. Co.

227 Volt Ammeter—A seven-range, clip-on volt ammeter is discussed as to design and use in illustrated List In. 17V. Explains special features in detail and includes dimensional data, price. Ferranti Electric, Inc.

228 Planned Lighting Guide—This selection guide features a chart which enables reader to see at a glance the application of each of company's 12 major lighting systems, covering practically every seeing task with illumination requirements from 10 to 150 ft-c. Another chart covers special lighting units for use in locations with combustible, dusty or damp atmospheres. Tells what to look for when appraising lighting equipment and a check list of benefits derived through proper application of planned lighting to industrial operations. Benjamin Electric Mfg. Co.

229 Precision Switches—Catalog 81, 20 pp, covers industrial switches for a-c circuits. Describes and illustrates general purpose basic switches, reset basic switches, auxiliary actuators, enclosed switches, explosion-proof and splash-proof types, limit switches and extra small switches. Includes full ordering information, technical data and definitions, price list and discount schedule. Micro Switch.

230 Answer Card—Rules of thumb for answering questions on capacities and applying power-factor-improvement are printed on a double card small enough to fit in plant engineer's wallet. With this card he can quickly compute the answers to the questions: How many kilovars? What power factor? How much voltage rise? Simplified diagrams illustrate formula for quick computation. Apparatus Dept., General Electric Co.

231 Power Transformers—Bulletin TU-181, providing more than 108 pp of descriptive and technical data, contains sections on power transformers and unit substations of both dry and liquid-filled types, on transformer performance and on company's transformer manufacturing facilities. Text is fully illustrated. Wagner Electric Corp.

232 Switch Tips—This is a regularly issued publication filled with good ideas and helpful suggestions on use of company's snap-action switches. Will be mailed to plant engineers who request it. Micro Switch.

MECHANICAL POWER TRANSMISSION

233 Flexible Couplings—Catalog FC-50 describes and illustrates roller chain flexible couplings for direct power drive applications stressing design features. Includes selection data, ratings, dimensions. Also includes descriptive and ordering information on coupling covers. Whitney Chain & Mfg. Co.

234 Transmission Belting Manual—Answers to most of the questions on transmission belting are provided in this 28-pp book. Illustrates company's beltings, gives specifications, tells how to select correct type for the job; also how to order belting, install it and maintain it in good operating condition. Filled with technical data, including comparisons, usefull formulas, tables of belt speeds, overload and correction factors. Republic Rubber Div., Lee Rubber & Tire Corp.

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235 Chain Drives—Engineering Catalog SCE-50, 68 pp, provides data on company's silent chain drives, giving their advantages, recommended applications. Also gives information on chain length calculation, installation and maintenance, dimensions, ratings, prices. Actual-size photos illustrate chain types, pitch. Includes full ordering data on sprockets.

Catalog CR-48, 16 pp, contains similar information on company's roller chain drives. Both books are available; ask for either or both. Whitney Chain & Mfg. Co.

PUMPS, COMPRESSORS

236 Centrifugal Pump Care—Sixteen-pp Bulletin 06X6256A is a revised handbook on the care of all makes of centrifugal pumps, giving the how and why of pump construction and their effect on pump maintenance. This informative booklet tells how to figure head and it carries tables to help determine friction loss. Causes and cures for various sources of troubles are offered along with a new maintenance timetable. Also included are little known facts about cavitation and how to protect pumps against it, water's role as a pump lubricant, common mistakes in packing stuffing boxes. Allis-Chalmers Mfg. Co.

237 Turbines, Pumps, Compressors—Bulletin 1181A provides an over-all presentation of company's line of steam turbines, centrifugal pumps, multi-stage pumps, and pumps specially designed to handle viscous fluids and oils, as well as blowers and compressors, and worm gear speed reducers. Includes photos of models and installations, cutaway illustrations and sectional diagrams to show design features. De Laval Steam Turbine Co.

238 Pumping Units—Bulletin 4303 is devoted to centrifugal pumping units with fan-ventilated drip-proof motors. Includes photos of pump assembly and parts, cutaway illustration. Provides full specifications and dimensional data, also selection chart for various capacities and heads and key to selection chart for 60 cycle motors. The Deming Co.

PIPING, TRAPS, SAFETY HEADS

239 Steam Trap Manual—"Solving Steam Trap Problems," 36 pp, covers correct trapping practice for unit heaters, jacketed kettles, autoclaves, submerged surfaces, hospital, kitchen and laundry equipment, steam mains, header drips etc. Tells how to select size and determine lift of trap. Explains theory, operation, maintenance; gives details of simplified piping for steam traps. Also discusses float traps, air release valves and pipe line strainers. Specifications, capacities and some prices are given. Book is illustrated throughout and includes condensate and steam tables. The V. D. Anderson Co.

240 Steam Traps—Impulse traps for power plant, steam distribution systems, industrial steam processes are described in 16-pp Bulletin T-1739. Illustrated with photos, cutaway and sectional drawings, it tells how to figure sizes needed, gives application data, installation and operating suggestions, capacities, weights, dimensions and prices. Yarnall-Waring Co.

241 How to Select Steam Traps—Contending that there is no universal trap, Selection Chart 1600 describes and illustrates thermostatic, inverted bucket, float thermostatic, and liquid expansion types giving advantages and recommendations for use. Includes table showing first and second choice of trap types for 34 applications. Sarco Co., Inc.

242 Pipe Hangers—Ninety-pp Catalog 10-D is a buyer's guide for adjustable pipe hangers and supports. Covers hangers for attachment to pipe and to structure, hanger assemblies, spring hangers, hanger rods, pipe supports and related equipment. Each type is described and illustrated by photos and dimensional diagram and listed with sizes, prices. Catalog also includes standard specifications, photos of installations and terms of sale. Indexed, ring punched. Grinnell Co., Inc.

243 Steam Traps—Bulletin 315 presents company's smaller steam traps designed for greater performance capacities. Illus-

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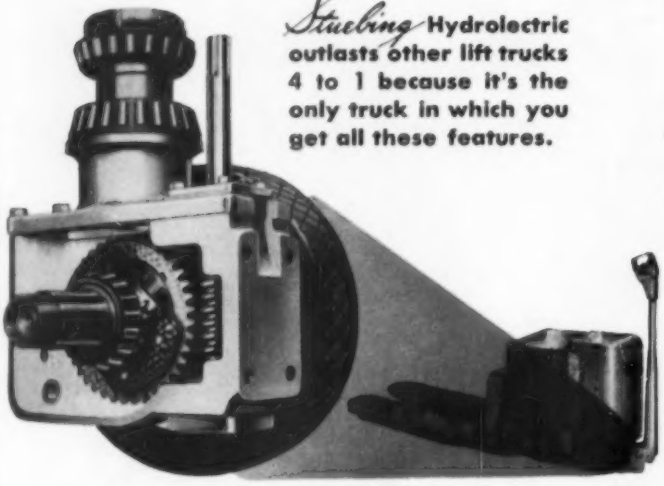

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trates and explains their design and operation, tabulates sizes and capacities and includes prices of traps and accessories. Also describes briefly and illustrates a differential drainage and boiler return system. Stickle Steam Specialties Co.

244 Safety Heads—Bulletin A-47 is an 8-pp booklet covering safety heads, safety head flanges, safety head rupture discs and relief valves, automatic chemical feeders and pressure vacuum vent valves. Twenty-seven photos and drawings illustrate products and fittings. Charts give capacities, ratings and specifications. Black, Sivalls and Bryson, Inc.

CONSTRUCTION

245 Roofing Manual—Full engineering data on manufacturer's roofings and their use is presented in Specifications 50, 36 pp. Covers not only coal tar pitch roofings, but also waterproofings, roof insulations, flashings, protective coatings. Includes illustrated instructions for the roofing of most types of roof construction, including methods of handling special conditions, amount of material required. Tar Products Div., Koppers Co., Inc.

246 Technical Data on Plexiglas—This is a file folder of technical and application information on Plexiglas sheets, rods and molding powders, covering their workability, physical properties, available thicknesses. Includes data sheets on the uses and advantages of Plexiglas in large area lighting, typical designs of coffers, photos of installations and a discussion of room lighting. Rohm & Haas Co.

247 Plexiglas Applications—This booklet illustrates many of the ways Plexiglas is now being used. Also gives physical properties, sizes and descriptive information about this acrylic plastic in sheet and rod forms and discusses molding powders and their use. Rohm & Haas Co.

248 Open Steel Flooring—This is a 24-pp illustrated catalog on riveted and welded flooring units for use as stair treads, platforms, walkways, decks, landings, runways, catwalks, boiler room installations, sidewalk gratings. Also covers anchors. Includes a typical layout for an open floor installation, also safe load table. Wm.

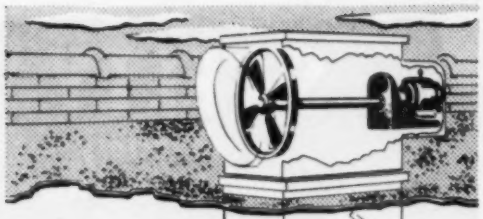
249 Steel Grid—Form 405 explains and illustrates heavy duty steel grid for prolonging life of old and new industrial floors and traffic surfaces. Tells economy and other advantages of the grid and provides directions for use over various types of surfaces. Photos illustrate instructions, also show several interior and exterior installations. Wm. F. Klemp Co.

250 Fastenings Data & Reference Book—This fingertip-indexed, reference and data book on stainless steel fastenings is designed to provide you with complete application and authoritative reference information regardless of industry and application. Separate sections are devoted to machine screws, nuts, caps and bolts, wood and sheet metal screws, rivets, nails, or what-do-you-want? List prices are given, too, along with a quantity discount chart intended to make cost estimating an easier job. Thousands of odd sizes and varieties are listed in a supplementary stock list. The book also tells about the company's special item order service. Anti-Corrosive Metal Products Co., Inc.

MAINTENANCE

251 Manual of System Planning, Preventive Maintenance—This 50-pp book covers complete story of electrical system planning and maintenance. Covers system functions; code reference chart; voltage drop tables; power factor charts; guides for motor wiring; guides for lighting wiring; electrical system records; supplementary feeder schedule; preparing electrical plans; switchboard and feeder schedule; riser diagram of complete system; motor and control schedule; symbols for wiring plans; preventive maintenance; diagnosing system conditions; general system survey; load survey. Anaconda Wire & Cable Co.

252 Industrial Products for Maintenance and Construction—This catalog is a comprehensive collection of data sheets on company's line of industrial products. It



brewery engineers control fumes with PROPELLAIR fans

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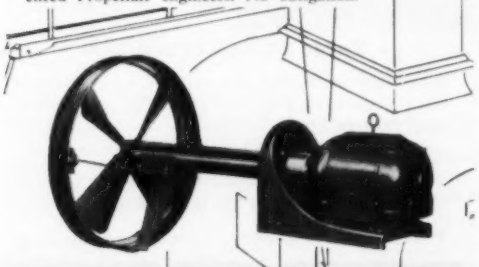

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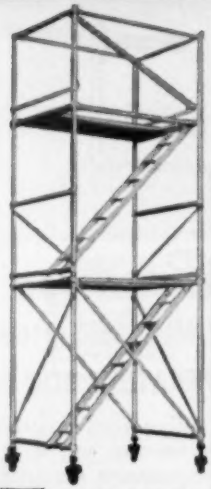

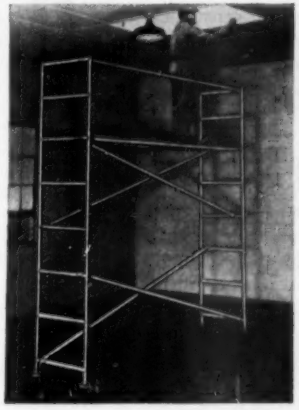

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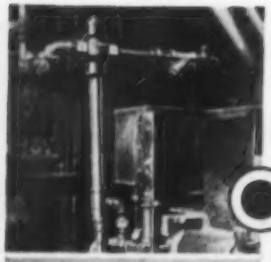
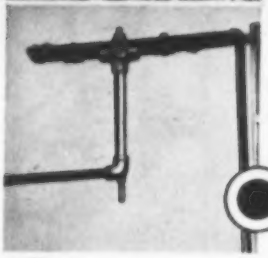


SAVING FLOUR



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In making syrup it's important to dissolve all the sugar for a better product — and lower cost. In macaroni, it's the art of getting the dough just right to go through the machines — without shut downs, rejected batches and wasted flour.

The Sarco Water Blender — a three way mixing valve operated by the famous Sarco bellows, goes into the line as easy as a T — and as quickly. It is not affected by normal changes in water temperatures or pressures. It costs little — very little considering what it does.

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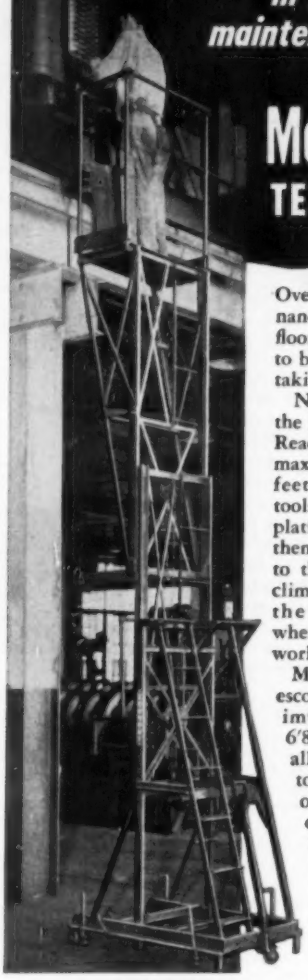

Overhead crane maintenance 22 feet above the floor, as illustrated, used to be a hazardous undertaking.

Now one man sends the platform of this Hi-Reach Telescoper to its maximum height of 15 feet, putting whatever tools he may need on the platform beforehand. He then walks up the steps to the first landing and climbs the ladder to reach the roomy platform where he is then able to work with full security.

Model PUL when telescoped down to its minimum height is only 6'8" high and 32" wide, allowing the machine to be taken through an ordinary doorway and onto freight elevators for transport to any part of the plant. Model PUL is equipped with basewheels and is fully portable.

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Other Hi-Reach Telescopers available with platform lifts up to 60 feet.

Write for full details of Model PUL and larger Telescopers.

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gives product descriptions, specifications and directions for use. Covers heavy duty mastic floorings, asphalt protective coatings, waterproofing and dampproofing materials, resilient floor covering underlayments, industrial adhesives and cementing compounds, pipe wrappings and coatings, Expansion joint sealers and fillers and other products. The Flintkote Co.

253 Building Maintenance Manual—Sixty-four-pp Handbook 7 is packed with useful information on the applications of an extensive line of floor surfacings and other maintenance products, as well as leak stoppers, external wall sealants, road patching, roofing materials. Illustrated throughout with photos and sketches it provides complete product information and step-by-step instructions for use. An extremely valuable reference book, it shows how to analyze problem, select right product, estimate quantity needed and carry out the work. Flexrock Co.

254 Rolling Scaffolds—Sectional tubular steel scaffolds for maintenance, painting jobs are described and illustrated in Bulletin PSS-14. Tells how to assemble basic units and how to increase working area. Includes photos of interior, exterior scaffolds. The Patent Scaffolding Co., Inc.

255 Protective Coatings — Filled with photos of equipment and structures protected by Company's corrosion-preventive coatings, Form 948-A, discusses this coating, tells how surfaces should be prepared for it, suggests ways to apply it and recommends thicknesses. Gives specifications for several solutions and explains value of the coatings in industrial atmospheres, around chemical fumes and moisture and in presence of deteriorating soil conditions, high temperatures. Tar Products Div., Koppers Co., Inc.

256 Floor Finish—A quick-drying finish for wood floors, described as ready for traffic in 30 min. is described in this folder. Tells merits of the finish and how to apply it. Includes full color photos showing how various shades of this finish look on different woods. L. Sonneborn Sons, Inc.

DUST AND FUME CONTROL

257 Dust Collectors—Operation, construction, versatility and maintenance of company's unit dust collectors are explained in this illustrated bulletin. Includes table of capacities, sizes, also photos of units. The Kirk and Blum Mfg. Co.

258 Electric Blowers—Illustrated Bulletin 573 describes portable electric blowers in ⅛ to 1¼ hp sizes for removing dust, dirt, grit and grindings from motors, bearings, shafting and gears. Emphasizes economy of blowers in cutting production and repair costs and saving power. Attachments for use with blowers to make them applicable for industrial vacuum cleaning jobs are also presented. Breuer Electric Mfg. Co.

259 Dust Control—Bulletin 909A, 28 pp, covers necessity and economy of controlling industrial dusts and use of dust control equipment. Describes, illustrates and gives specifications for cloth screen collector. Gives application and engineering data and photos of several installations; also discusses other dust handling equipment. Includes questionnaire outline information needed for analysis of individual plant problems. Pangborn Corp.

260 Welding Fume Collectors—Bulletin 37-D describes and illustrates fume collecting equipment for welding operations. Discusses advantages of collecting fumes at the source, hood protection, good working range, easy installation. Illustrates regular, long-reach and special collectors, giving dimensions and location information. Also describes ventilated welding cabinet. Ruemelin Mfg. Co.

261 Vacuum of Many Jobs—Bulletin 144, 20 pp describes and illustrates 132 unusual industrial uses for company's vacuum system. Applications, listed alphabetically, range from the removal of dust from inside of rolls of adhesive tape to recovery of zinc dust. The Spencer Turbine Co.

262 Positive Displacement Blower—Publication 84 presents an axial flow, high

WeldOlets, Butt Welding — Available as standard, with outlet sizes from ⅛" to 24", both straight and reducing for use with Schedule 40 pipe up to 12" outlet. Outlet sizes 12" - 24" for standard weight pipe (⅜" wall). Also available for Schedule 80 services through 8" outlet and extra strong through 24" outlet size (for use with pipe having ½" wall).

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SPEED, ECONOMY AND FULL PIPE STRENGTH

***into the job when you specify* WELDOLETS**

With WeldOlet branch pipe welding fittings you provide the quickest, most economical, most satisfactory method of obtaining full pipe strength at branch connections.

Note in the above illustration how the WeldOlet tapers to provide a single bevel groove joint at the crotch section and blends into a V-butt joint at the ear portion.

WeldOlets need no additional reinforcement to establish and fully maintain original strength on ASTM A-106 Seamless Steel Grade A Pipe, as set forth in Code for Pressure Piping, American Standards Association, B31.1-1942, and Supp. No. 2, B31.1-b-1947.

To meet special conditions, these fittings can be furnished in any forgeable metal including wrought iron, toncan iron, nickel, Monel, Everdur, stainless grades 304, 316, 347, etc.

For detailed engineering reference data, write for Catalog W-2.

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FOR WELDED BRANCH PIPE OUTLETS

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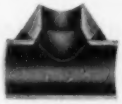

Fig. 1—Cut-away view of reducing size WeldOlet with welding outlet in place. The external rib and wide bases or footings of WeldOlets eliminate the need for extra supports to take care of bending or vibrational stresses at crotch section, the point of greatest stress.

Fig. 2—Note blending of ear portion of welding fitting to run pipe. Extension of weld metal below inside scarfed portion of pipe insures all sections of joint greater than pipe wall thickness.

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speed blower for handling gas or air under pressure or vacuum from 20 to 15,000 cfm. Photos show complete unit, principal parts. Discusses advantages, lists applications, gives specifications. The Standard Stoker Co., Inc.

TOOLS

263 Tool Catalog—Company's complete line of hand and power tools, tool sets, kits and related equipment is presented in Catalog T, 110 pp. Illustrated with photos of all items listed. It describes tools, includes sizes, applications, shipping weights, other ordering data. Snap-On Tools Corp.

264 Pipe Bending Tools—Pocket-size Bulletin E-201, 16 pp, describes hydraulic and hand operated units for bending iron, steel and non-ferrous pipe, rigid conduit, tubing and bus bars. Illustrates each type of tool and tells its applications, sizes. Also describes a power pump for hydraulic units. Stresses economy and efficiency of portable units for making tailored bends on the job. Greenlee Tool Co.

265 Pipe Tool Ordering Guide—Catalog 50, 36 pp, covers entire line of pipe tools, machines, power drives, threading oil. Products are illustrated by photo and operational advantages fully explained. Includes concise ordering specifications, current price list. Beaver Pipe Tools, Inc.

VIBRATION CONTROL

266 Machine Mountings—This folder describes and illustrates use of a vibration isolating and shock absorbing material recommended for use as machine mounting or as component parts. Explains how material functions and how it is installed. Fabreeka Products Co.

267 Vibration Control — The advantages and limitations of spring mountings, rubber mountings and cork materials in the control of vibration, together with data on their use are given in Bulletin G-102. A selector chart tabulates more than 50 applications and recommends types of isolators for both highest efficiency and satisfactory operation under less critical conditions. Loading ranges are given for all types. Also described are isolators for special applications. Korfund Co., Inc.

MAGNETIC SEPARATION

268 Separators and Detectors—This illustrated catalog describes permanent non-electric magnetic separators and electronic metal detectors. Specifications on weights, sizes and strength comparisons are given as well as tables of operating capacities for permanent magnetic pulleys, drums, pneumatic line assemblies, pipeline traps, road sweepers and pipe rolls. Eriez Mfg. Co.

269 Magnetic Equipment — Illustrated Catalog C-5000A covers magnetic separating and detecting equipment. Includes photos, descriptive and application information, sizes and capacity data on electric and non-electric pulleys and drums, rectangular magnets, lifting magnets, non-electric plate and liquid line magnets, roll and cross belt separators, and other equipment. Dings Magnetic Separator Co.

MISCELLANEOUS

270 Four Handy Guides for Plant Engineers—Bulletin 20B 6051J, 12 pp, offers data on figuring V-belt drives; Bulletin 51B 6052K, 12 pp, for quick selection of electric motors; Bulletin 52B 6039E, 16 pp, for selection of centrifugal pumps, and Bulletin 25B 6150B, 32 pp, for a description of equipment for power generation, distribution and control. Any or all of these booklets are available—specify those wanted. Allis-Chalmers Mfg. Co.

271 Industrial Rubber Products—This is a comprehensive collection of data covering all types of hose, belting, packing and other rubber products manufactured by company, including work gloves and helmets, linings, and hard rubber items. Fully illustrated, provides descriptions, specifications for all products as well as recommended applications. The B. F. Goodrich Co.

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272 Steel Work Benches—Form 701 is an ordering guide for work benches, illustrating models and providing explanation of features as well as listing dimensions and specifications and available top materials. Also gives ordering data on drawer tiers, continuous benches, bench tops, parts and accessories. Standard Pressed Steel Co.

273 Steam Generators—A bulletin compiled to present information needed for ordering packaged steam generators, this features a large, 2-color cutaway illustration and explanation of design features. Includes full specifications and dimensions as well as test data. Superior Combustion Industries, Inc.

274 Steam Pipe Line Products—Folder 349 is an over-all presentation of manufacturer's products for the distribution and utilization of steam, gas and liquids. Includes photos and brief descriptions of heat exchangers, expansion joints, flow and condensation meters, strainers, traps, and separators. American District Steam Co.

275 Metal and Asbestos Gaskets — This 32-pp catalog covers company's stock gaskets of all types as well as gaskets fabricated to specifications. Illustrated with photos it includes full specifications, dimensions, application data. Also contains engineering data helpful in estimating gasketing needed. United States Gasket Co.

276 Payroll Tabulation—Bulletin TM 598 presents five sample payroll tabulations demonstrating ability of company's tabulating machines to produce payrolls, earnings records, other reports required in payroll procedure. Remington Rand, Inc.

277 Chemical Proportioning Literature—Bulletin CAT lists more than 50 available bulletins and reprints of articles published by manufacturer on the general subject of constant rate and flow responsive chemical proportioning. Material listed covers equipment, methods and applications. %Proportioneers, Inc.%

278 Visual Planning Equipment — The importance, application, and cost of three-dimensional planning material is presented in this file of helpful data. Tells reasons why proper planning is basis for manufacturing cost reductions and includes many photos of typical visual layouts. Also quotes prices of visual material and provides instructions for ordering it. "Visual" Planning Equipment Co., Inc.

279 Manual on Overhead Conveying Systems—This comprehensive handbook, Conveying Manual A-86 contains more than 200 pp of information from manufacturer's catalogs on overhead track systems and conveying equipment. Book is generously illustrated with photos of equipment, installation and construction details, and it provdes full engineering and application data as well as complete catalog listings of equipment. Richards-Wilcox Mfg. Co.

280 Phone Booths for Noisy Spots—Bulletin 184 provides photos of several of company's floor and wall model phone booths designed to permit telephone conversations in factories, utility plants, commercial buildings. Stresses advantages and versatility of the booths and describes and illustrates construction. Burgess-Manning Co.

281 Tube Cleaners—Bulletin Y-29 describes and illustrates tube cleaners for all purposes. This handy guide covers applications of tube cleaners for removing scale and other types of encrustation from tubes or pipes in boiler room equipment, oil refineries, process plants and other locations. Various types of motors, cutter heads, drills, brushes, operating hose and couplings are fully described and the bulletin offers many helpful hints on the care and operation of tube cleaners. Lagonda Div., Elliott Co.

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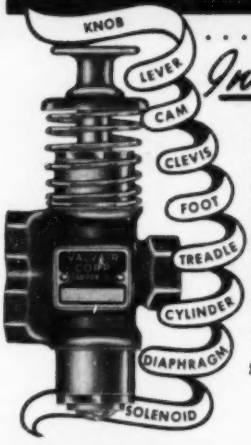

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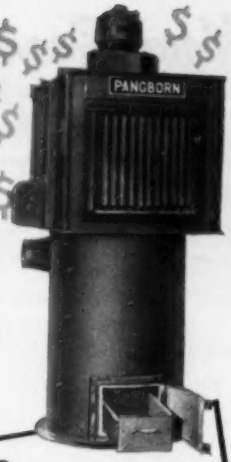

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New Books for Plant Engineers

An asterisk (*) following the title of any book described in this department indicates that the book may be purchased from the Book Department, PLANT ENGINEERING, 110 S. Dearborn St., Chicago 3, Ill.

More (Heat) Power to You*

HEAT POWER FUNDAMENTALS by Carroll M. Leonard and Vladimir L. Maleev. Size 6 by 9 in.; 596 pp; illustrated; cloth bound. Published by Pitman Publishing Corp. Price $5.75.

THIS NEW BOOK on heat power fundamentals has a number of interesting features and although it is intended primarily as a textbook for students taking a first course in heat power engineering, it should prove useful to engineers. For the most part it is not too mathematical and the discussion begins not with thermodynamic theory but with a discussion of the steam power plant as a unit, treating both industrial and central stations and showing drawings of modern stations such as Mystic and Sewaren.

The book covers steam engines and turbines, condensing equipment, heating and pumping, boilers and superheaters, fuels and combustion, fuel burning equipment, the gas turbine and refrigeration. Other chapters cover the fundamentals of thermodynamics, steam, vapor cycles and internal combustion engines.

Of particular value is the selection of problems after each chapter, also the list of references for collateral reading. At the end of the book are steam tables and pipe tables.

Industrial Lighting Reports

Lighting reports for Textile Mills, Machining Small Metal Parts, and Canneries. Size 8½ by 11 in.; paper bound. Published by Publications Office, Illuminating Engineering Society, 51 Madison Avenue, New York 10, N. Y. Price 50 cents per copy of each report.

LIGHTING FOR WOOLEN AND WORSTED TEXTILE MILLS. This 12 page report describes and illustrates the various operations from wool sorting through the finished cloth, recommending proper levels of illumination in each, correlated with considerations of flexibility, installation, maintenance and production records. The resulting report serves as a complete guide to illumination in woolen mills and is of particular value to maintenance departments, utility company lighting departments, manufacturers of industrial lighting equipment and others.

LIGHTING FOR MACHINING OF SMALL METAL PARTS. This 16 page illustrated report recommends lighting for operations from general and supplementary lighting through lighting for specific tasks, with special attention in the latter section to measuring instruments and rules, and graduated feed indicating scales. Other sections prescribe illumination for bench work and inspection, in addition to lighting for precision type lathes, internal and external grinders, shapers and drill presses.

LIGHTING FOR CANNERIES. Canning operations require a

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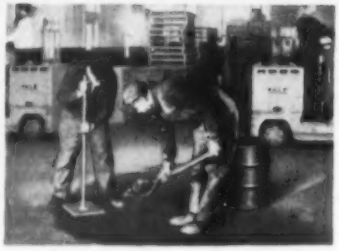

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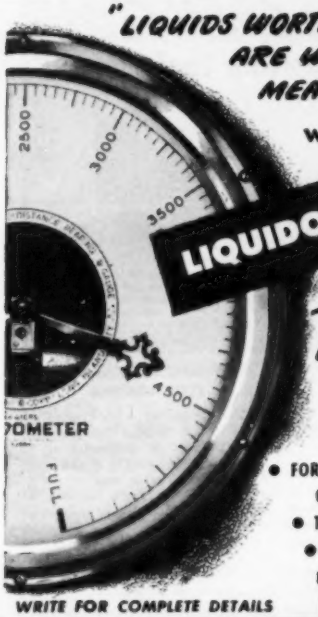

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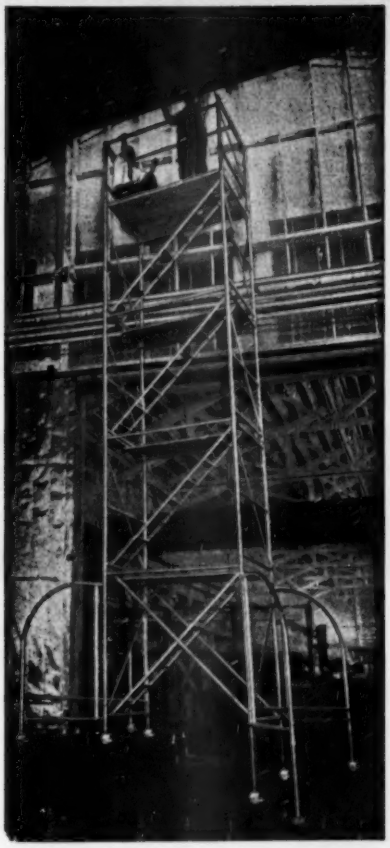

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great amount and variety of supplementary lighting to illuminate such important seeing tasks as sorting, grading, preparing and canning of fruits, vegetables and other products, as well as adequate illumination in the working areas. With these two general conclusions in mind, the IES has just published a completely illustrated 36 page booklet describing the recommended lighting conditions through all operations of the canning processes.

In addition to recommendations for lighting actual processing areas, the study describes illumination for offices and laboratories and constitutes a complete lighting guide for anyone concerned with illumination for canneries, including maintenance departments, utility companies, lighting equipment manufacturers and others.

Effective Speech for All Occasions

HOW TO TALK MORE EFFECTIVELY by Jean Bordeaux. Size 5½ by 8½ in.; 218 pp; illustrated; cloth bound. Published by The American Technical Society, Drexel Avenue at 58th St., Chicago 37, Ill. Price $2.75.

ALL THE REASONS why men must learn to talk effectively have been discussed so many times that we shall not mention them here. This book reviews them very well in its first chapter, Leaders Must Speak Effectively. It then goes on to explain the influence of personality and the quality of your speech in producing the effect you want when addressing an audience.

The book includes discussion of microphone technique, of town meeting and panel type techniques, and a good chapter on how to use the telephone.

The author tells you how to introduce speakers at a meeting, how to persuade without furious and futile argument, how to leave your audience laughing, how to interview somebody and how to be interviewed. Among the most important parts of the book are the chapters on how you are selling all the time.

Listing of Engineering Research Projects

Review of Current Research and Directory of Member Institutions by Engineering College Research Council. Size 6 by 9 in.; 180 pp; paper binding. Published by Engineering College Research Council of the American Society for Engineering Education. Address orders to F. M. Dawson, Chairman, c/o College of Engineering, State University of Iowa, Iowa City, Iowa. Price $1.75.

OVER 4000 current college and university research projects in engineering are listed by title in the 1949 Review of Current Research.

Entries in this book from 82 educational institutions, describe the administrative policies for conducting engineering research and list the responsible personnel, research expenditures, short courses and conferences of special interest, and the titles of all engineering research studies active at present at each institution.

There is a complete index to research project subjects and the projects are broken down according to the engineering departments involved.

A Guidebook for Planning Pensions*

HOW TO PLAN PENSIONS, A Guidebook for Business and Industry, by Carroll W. Boyce. Size 5½ by 8½ in.; 479 pp which includes 113 pp of Appendix material; cloth bound; first edition. Published by Whittlesey House. Price $5.00.

WITH PENSIONS the keynote of much business and industrial activity today, you will find this timely book the answer to your pressing need for a concise, clear and simplified explanation of "what pensions are all about."

Step by step, it explains business and industrial pension

(Continued on page 124)

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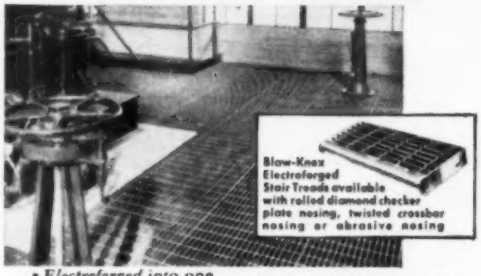
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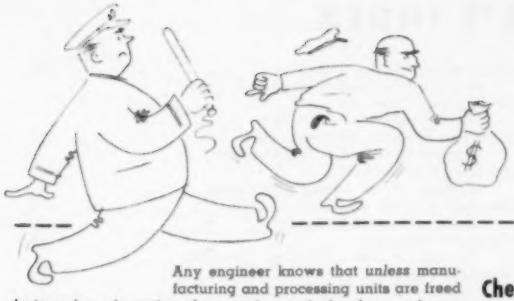

Stop the Thief

that is stealing your fuel and production!

Any engineer knows that *unless* manufacturing and processing units are freed of air and condensation, they steal your fuel, rob you of your production potential. Surest way to stop the thief is to install Stickle Steam Traps. Take the Stickle Series 100 Steam Trap, illustrated here. It's built for low-cost, *straight-in-line* installation. You save piping, fittings, labor. No by-pass to build because Stickle has already built it in! Just a quarter turn of the nut in the trap top does the trick. Nut is actually part of the valve seat, which is located above trap to minimize dirt and scale interference.

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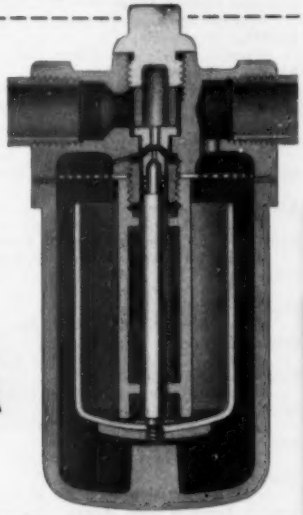

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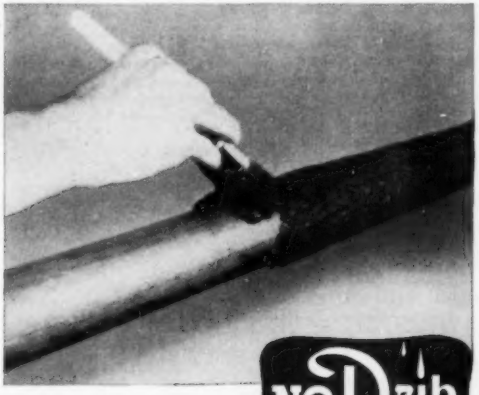

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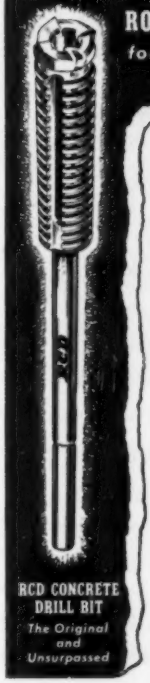

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ADVERTISER'S INDEX

Allis-Chalmers Mfg. Co. ..... Back Cover
Agency—Compton Advertising Agency
Aluminum Company of America 75
Agency—Fuller & Smith & Ross, Inc.
American Air Filter Company, Inc. ..... *
Agency—The Griswold—Eshleman Co.
American Brass Company, The 23, 79
Agency—Kenyon & Eckhardt Inc.
American District Steam Co. 114
Agency—Squier and Davis, Inc.
American Engineering Co. ..... *
Agency—Beatty and Oliver, Inc.
American Monorail Co., The ..... *
Agency—The Bayless-Kerr Company
Anderson Co., The V. D. 103
Agency—Will, Inc.
Annin Co., The ..... *
Agency—The McCarty Co.
Anti-Corrosive Metal Products Co., Inc. 107
Agency—Woodard & Fris, Inc.
Armstrong Machine Works 5
Agency—Russell T. Gray, Inc.
Arrow-Hart & Hegeman Electric Company, The 80
Agency—Hugh H. Graham & Associates, Inc.
Atlas Valve Co. 100
Agency—W. F. Schaphorst
Beaver Pipe Tools, Inc. 98
Agency—Meek and Thomas, Inc.
Benjamin Electric Mfg. Co. ..... *
Agency—Van Auken, Ragland & Stevens
Binks Manufacturing Company 42
Agency—Homer J. Buckley & Associates
Black, Sivalls & Bryson, Inc. 32-33
Agency—The Potts-Turnbull Company
Blaw-Knox Company 120
Agency—Russell T. Gray, Inc.
Blue Ridge Glass Corp. 36
Agency—Fuller & Smith & Ross, Inc.
Bonney Forge & Tool Works 113
Agency—Scherhagen, Incorporated
Breuer Electric Mfg. Co. 96
Agency—Gebhart & Brockson, Inc.
Burgess-Manning Co. ..... *
Agency—The Fensholt Co.
Cash Company, A. W. 12
Central States Distributors, Inc. 120
Agency—Admakers
Clarage Fan Company ..... *
Agency—William J. Williams
Cleveland Crane & Engineering Co., The ..... Inside Back Cover
Cochrane Corporation 106
Agency—Willard G. Myers Advertising Agency
Cook's Sons, Inc., Adam ..... *
Crane Co. ..... *
Agency—The Buchen Company
Dampney Company of America, The ..... *
Darling Valve & Manufacturing Co. ..... *
Agency—The Griswold-Eshleman Co.
Dart Mfg. Co., F. M. 40
Agency—Sutherland-Abbott
De Laval Steam Turbine Co. 119
Agency—Geo. H. Gibson Co.
Deming Co., The ..... *
Agency—G. M. Basford Co.
Detroit Steel Products Company 27
Agency—Fuller & Smith & Ross, Inc.
Diamond Chain Company, Inc. 21
Agency—Kirkgasser-Drew
Dings Magnetic Separator Company ..... *
Agency—Russell T. Gray, Inc.
Dollinger Corporation 101
Agency—Casler, Hempstead & Hanford, Inc.
Economy Engineering Company 112
Agency—Kreicker & Meloan, Inc.
Edmont Mfg. Co. 117
Agency—Mumm, Mullay & Nichols, Inc.
Elliott Company 39
Agency—Horton-Noyes Co.
Erie City Iron Works 124
Agency—Davies & McKinney
Ericz Manufacturing Company 13
Agency—John Mather Lupton Company
Everlasting Valve Co. ..... *
Agency—Mickel-Cather, Inc.
Fabreeka Products Company, Inc. ..... *
Agency—Edmund S. Whitten, Inc.
Feedrail Corporation 115
Agency—W. L. Towne Advertising
Ferranti Electric, Inc. 108
Agency—Rose-Martin, Inc.
Flexrock Company 118
Agency—Walter S. Chittick Company
Flintkote Company, The 93
Agency—Marchalk & Pratt Co.
Fuller Brush Co. 22
Agency—John B. Fairbairn
Fuller Company 97
Agency—O. S. Tyson and Company, Inc.
Garlock Packing Co., The ..... *
Agency—Hutchins Adv. Co., Inc.
General Electric Company 24-25, 35
Agency—G. M. Basford Co.
General Electric Company, Construction Materials Dep't. ..... *
Agency—G. M. Basford Co.
Golden-Anderson Valve Specialty Co. ..... *
Agency—Walker & Downing
Goodrich Co., The B. F. 3
Agency—The Griswold-Eshleman Co.
Goulds Pumps, Inc. ..... *
Agency—Charles L. Rumrill & Co., Inc.
Greenlee Tool Co. ..... *
Agency—Howard H. Monk and Associates
Grinnell Company, Inc. ..... *
Agency—Horton-Noyes Co.
Gulf Oil Corporation ..... *
Agency—Young & Rubicam, Inc.
Hall Laboratories 7
Agency—Ketchum, MacLeod & Grove, Inc.
Harnischfeger Corporation 15
Agency—The Buchen Company
Hartzell Propeller Fan Co. ..... *
Agency—The Kight Advertising Co.
Hillyard Chemical Company 115
Agency—Phillips-Reich-Fardon
Horn Co., Inc., A. C. 85
Agency—J. D. Tarcher & Co., Inc.
International Nickel Co., Inc., The 14, 89
Agency—Marchalk & Pratt Co.
Jefferson Electric Co. 28
Agency—Kirkgasser-Drew
Jeffrey Mfg. Co., The 43
Agency—Byer & Bowman Adv. Agency
Jenkins Bros. ..... *
Agency—Horton-Noyes Co.
Joy Mfg. Co. 87
Agency—Walker & Downing
Kennedy Valve Mfg. Co. 86
Agency—Charles L. Rumrill & Co., Inc.
Kirk & Blum Mfg. Co., The 41
Agency—The S. C. Baer Company
Koiled Kords 102
Agency—Hugh H. Graham & Associates, Inc.
Koppers Co., Inc. ..... *
Agency—Vansant, Dugdale & Company, Inc.
Koppers Co., Inc., Tar Products Division 105
Agency—Batton, Barton, Dustine & Osborn, Inc.
Korfund Company, Inc., The ..... *
Agency—Sanger-Funnell, Inc.
Legge Co., Inc., Walter G. 82
Agency—Royer & Roger, Inc.
Lewis-Shepard Products, Inc. 78
Agency—Edmund S. Whitten, Inc.
Lift Trucks Incorporated 110
Agency—The S. C. Baer Company
Liquidometer Corp., The 119
Agency—Lucerna Co., Inc.
Maguire Co., Inc., Walter ..... *
Agency—O. S. Tyson and Company, Inc.
Merceid Corporation, The 108
Metallizing Engineering Co., The 95
Agency—The Schuyler Hopper Co.

Micro Switch ..... •
Agency—Hamilton Advertising Agency
Mortell Co., J. W. 121
Agency—Weston-Barnett, Inc.
Niagara Blower Company ..... •
Agency—The Moss-Chase Co.
Nicholson & Co., W. H. 26
Agency—Wilbur A. Myers
Paasche Airbrush Co. ..... •
Agency—Merchandising Advertisers, Inc.
Pangborn Corp. 117
Agency—Vansant, Dugdale & Company
Patent Scaffolding Co., Inc., The 111
Agency—Glenn, Jordon, Stoetzel, Inc.
Powers Regulator Co., The 123
Agency—Symonds, Mackenzie & Co.
% Proportioneers, Inc. % 90
Agency—Hammond-Goff Co.
Remington Rand, Inc. 77
Agency—Leeford Advertising Agency, Inc.
Republic Rubber Division 31
Agency—Meek & Thomas, Inc.
Richards-Wilcox Mfg. Co. 94
Agency—George H. Hartman Company
Robbins & Myers, Inc. 6
Agency—Erwin, Wasey & Co., Ltd.
Robbins & Myers, Inc. 111
Agency—Byer & Bowman Adv. Agency
Robertson Co., H. H. 44
Agency—Fuller & Smith & Ross, Inc.
Rohm & Haas Company 29
Agency—John Falkner Arndt & Company, Inc.
Rotary Concrete Drill Co. 121
Agency—Neale Advertising Associates
Rowe Methods, Inc. 103
Agency—Stedfeld & Byrne, Inc.
Ruemelin Mfg. Co. 106
Agency—Paulson-Gerlach & Associates, Inc.
Safway Steel Products, Incorporated 124
Agency—The Cramer-Krasselt Co.
Sarco Company, Inc. 112
Agency—W. L. Towne Advertising
Sexauer Mfg. Co., Inc., J. A. ..... •
Agency—Reiss Advertising
Shell Oil Company 10-11
Agency—J. Walter Thompson Company
Shepard Niles Crane & Hoist Corporation ..... •
Agency—Baker, Jones, Hausauer, Inc.
Simplex Valve and Meter Company 88
Agency—Cunningham & Walsh, Inc.
Skinner Co., M. B. 108
Agency—Jones & Taylor and Associates
Sly Mfg. Co., The W. W. ..... •
Agency—The Bayless-Kerr Co.
Smooth-On Mfg. Co. ..... •
Agency—Michel-Cather, Inc.
Snap-On Tools Corporation 84
Agency—Scott, Inc.
Sonneborn, Inc., L. 102
Agency—Hicks & Greist, Inc.
Speedway Conveyors, Inc. ..... •
Agency—Charles L. Rumrill & Co., Inc.
Speer Carbon Company ..... •
Agency—O. S. Tyson & Company, Inc.
Spencer Turbine Co., The ..... •
Agency—W. L. Towne Advertising
Stalwart Rubber Company 104
Agency—Penn and Hamaker, Inc.
Standard Pressed Steel Co. 118
Agency—R. E. Lovekin Corp.
Standard Stoker Company, Inc., The ..... •
Agency—Davies & McKinney
Stickle Steam Specialties Company 121
Agency—Caldwell, Larkin & Company, Inc.
Stemco Corporation 30
Agency—Fuller & Smith & Ross, Inc.
Superior Combustion Industries, Inc. ..... •
Agency—Charles H. Davis
Superior Electric Company, The 100
Agency—Hugh H. Graham & Associates, Inc.
Swartwout Co., The 76
Agency—Carr Liggett Advertising, Inc.
Templeton, Kenly & Co. ..... •
Agency—Glenn, Jordan, Stoetzel, Inc.
Texas Company, The ..... Inside Front Cover
Agency—Erwin, Wasey & Co.
Tide Water Associated Oil Company 109
Agency—G. M. Basford Company
Trimont Mfg. Co. 16-17
Agency—Horton-Noyes Company
Troy Engine & Machine Company 116
Agency—Sanger-Funnell, Inc.
Trumbull Electric Mfg. Co. 45
Agency—James Thomas Chirurg Co.
United States Gasket Co. 96
Agency—McLain-Dorville, Inc.
Up-Right Scaffolds 119
Agency—Norton M. Jacobs Advertising Agency
U. S. Hoffman Machinery Corporation ..... •
Valvair Corporation 117
Agency—C. A. Reece
Visual Planning Equipment Co., Inc. ..... •
Wagner Electric Corporatin ..... •
Agency—Arthur R. Mogge, Incorporated
Westinghouse Electric Corporation 8-9, 64-65, 83
Agency—Fuller & Smith & Ross, Inc.
Westinghouse Electric Corporation Elevator Div. 99
Agency—Fuller & Smith & Ross, Inc.
Whitney Chain Company 81
Agency—Sutherland-Abbott
Wickwire Spencer Steel Div. of C F & I 19
Agency—Doyle, Kitchen & McCormick, Inc.
Wiegand Company, Edwin L. 98
Agency—Smith, Taylor & Jenkins, Inc.
Williams Gauge Co., The ..... •
Agency—Walker & Downing
Winkelman Co., The ..... •
Worthington Pump & Machy. Corp. ..... •
Agency—James Thomas Chirurg Co.
Yarnall-Waring Company 46
Agency—Walter S. Chittick Company

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(Continued from page 120)

systems, describes the cost factors involved, summarizes recent negotiated plans, digests the report of the presidential steel fact-finders, and includes examples of typical pension plans.

This guidebook answers your challenging questions on all aspects of the pension planning problem—eligibility requirements, retirement age, methods of financing and administering, the role of social security, the impact of pensions on bargaining, etc. Convenient check lists are included to show the negotiator what pitfalls he may expect to encounter and how to avoid them.

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Some of the material presented covers Hygrol liquid charts for determining air leaving dew point temperature and dry bulb temperature; capacity corrections for various water quantities; logarithmic mean temperature difference table; flow and control diagrams of water coolant, Niagara Aero heat exchanger, liquid coolers, etc. A fold out Bulkeley Psychrometric chart is also included with this material.

Chemical Study of Industrial Poisons*

THE CHEMISTRY OF INDUSTRIAL TOXICOLOGY by Hervey B. Elkins. Size 5½ by 8½ in.; 406 pp including index; cloth bound. Published by John Wiley & Sons, Inc. Price $5.50.

IN THIS BOOK an attempt is made to treat industrial poisons primarily from the point of view of the chemist and engineer. This means that the harmful substances themselves will be emphasized, and the industrial processes in which they are used, rather than the physiological effects of poisons on the human body.

After a general treatment of poisons and the more important tests for discovering them, chapters 3 to 11 offer a detailed study of over 200 industrial poisons—physical properties, harmful effects, maximum allowable concentrations, and best methods of determining whether a danger is present.

The author then turns to the processes which produce toxic substances. He analyzes the toxic danger involved in each type of process, summarizing much of the material in easy-to-use tables. He also gives a list of maximum allowable concentrations of 203 substances in air and 12 substances in urine.

The last two chapters tell exactly what equipment is needed to test for toxic substances and what procedures should be followed.

An asterisk (*) following the title of any book described in this department indicates that the book may be purchased from the Book Department, PLANT ENGINEERING, 110 S. Dearborn St., Chicago 3, Ill.

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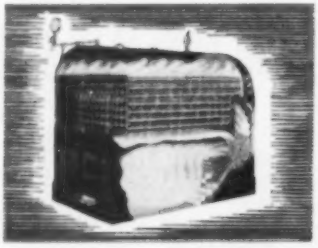

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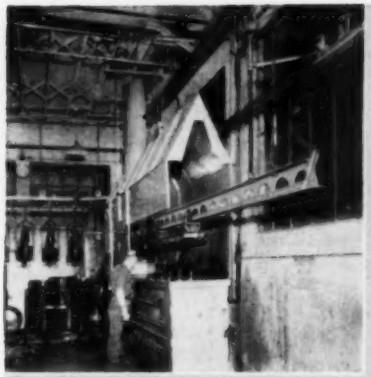

Armatures are dipped into varnish by use of a tramrail drop section which later is raised permitting carrier to travel forward.

After draining, armatures are advanced to oven. Carriers are traveled slowly through oven by motor-driven chain drive.

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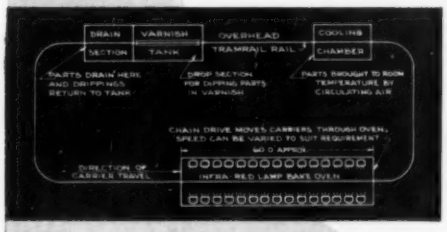
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